YEAR 2002 ANNUAL FISHERIES REPORT

EVERGLADES NATIONAL PARK

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Thomas W. Schmidt, Jason Osborne, and John Kalafarski

South Florida Natural Resources Center
Everglades National Park
40001 State Road 9336
Homestead, FL 33034

WEB SITE- http://www.nps.gov/ever/current/report.htm

INTRODUCTION

National Park Service (NPS) management policies state that recreational fishing is permitted in parks when it is authorized by federal law or is not specifically prohibited, and is in accordance with applicable federal/state laws and regulations. However, the NPS may restrict fishing activities whenever necessary to achieve management objectives. NPS goals and management objectives are based on the preservation of diversity and ecological integrity of fish populations. When harvest is permitted, in no case should it be allowed to reduce the reproductive potential of the population or to radically alter its natural (unfished) age structure. Fishing activity and harvest of sportfish from Everglades National Park (ENP) have been monitored nearly continuously since 1958. The objectives of fisheries monitoring in the park are to estimate the Catch Per Unit Effort (CPUE, also known as catch rate), relative abundance, age structure, total harvest, and boating and fishing activity.

This monitoring program was initiated because of concern over increased fishing pressure resulting from the construction of a highway, marina facilities, and an access canal to Whitewater Bay in 1958. The first ten years of the park's fishery monitoring program (1958-1969) were conducted through the University of Miami's Institute of Marine Science and were directed at evaluating only the sport (recreational) fishery. Under this program, measures of catch and cpue were made only from those fishermen operating out of Flamingo. This data covered a large part of the fishery, but missed two other major areas: eastern Florida Bay and the lower 10,000 Islands.

In 1965, a permitting system was established for commercial fishermen operating in ENP. These fisheries included commercial hook & line (primarily spotted seatrout), netting (mullet and pompano) stone crab trapping, and professional guides. Until 1972, this catch data consisted of monthly total harvest, by species, for each fisherman. The harvest reports did not include any measure of fishing effort or specific area of harvest, so it was not possible to monitor populations by ecosystem or management unit, or to evaluate the degree to which fishermen complied with reporting requirements.

In 1972, the NPS expanded the monitoring program to include daily trip ticket reports from commercial permit holders and developed censusing techniques to evaluate total parkwide sport fishing and commercial effort. The primary emphasis of the expanded monitoring was to improve the precision of the catch rate and total fishing effort estimates for both sport and commercial fisheries (Davis 1979a). In 1974, fish size data was added to the information recorded and, in 1980, Chokoloskee-Everglades City boat ramps were added on a routine basis.

In 1978, a second detailed account of the park's fishery database was completed in response to sport fishermen and guide complaints of declining stocks. The results of this assessment were incorporated into a document for public review concerning alternative fishery management options for ENP (Davis 1979b). This assessment summarized the estimated total harvest of fish from park waters by species, by area, and fishermen type

from 1973-1977; however, no detailed analysis of catch rate response to changes in effort or to environmental factors were made. Insufficient fish length data also were available in 1979 to evaluate such important parameters as age structure, mortality rates, and response to changes in fishing effort and harvest.

During the late 1980's, Virtual Population Analysis (VPA) cohort stock assessments for the park's major fish species, based on a 10-year collection (1974-1984) of 40,000 fish length measurements, were conducted. VPA's are statistical models which use catch data to produce relative estimates of how many fish of a given species exist or how many of a particular age class are surviving to become spawners. Park stock assessments included total mortality estimates, age structure, and a yield-per-recruit analysis for the three most commonly caught sportfishes: spotted seatrout, red drum, and gray snapper (Tilmant et al. 1986, Rutherford et al. 1989a, 1989b). This review concluded that environmental factors might explain as much of the variability in fish abundance as does fishing pressure.

Stock assessments, status and trend reports, and fisheries presentations for the period 1994-2001 are briefly discussed in previous (1995-2001) annual fisheries reports. For year 2002, project personnel participated in several scientific and management meetings, and stock evaluations/assessments. Proposed new snook regulations for the west coast of Florida based partially on the analysis of the Park's fisheries database were established and enacted beginning in January 2002, which reduced the bag limit from 2 to 1 and closed the month of May. Snook over 34" have not been permitted for harvest since December 30, 1998. Other on-going snook issues included causes of short-term changes in catch rates of snook and snook/red drum differences in catch rates associated with live bait and artificial bait use in Park coastal waters. In September 2002, project personnel also attended an informative Fish Identification Training/Workshop at Florida Marine Research Institute (FMRI) in St. Petersburg, FL. In addition, project personnel conducted sportfish interviews and gathered fish length information at Dry Tortugas National Park (DRTO) in July-August 2002.

Creel data from the 2002 ENP survey was provided to FMRI in St. Petersburg to generate stock assessments and status and trends reports for snook, spotted seatrout, and red drum. A cooperative NMFS/SEFC (Miami) and ENP catch analysis report on goliath (jewfish) grouper is planned for 2003. A Final Report was completed on the abundance of fishes and macro-invertebrates in Florida Bay (Johnson and Browder, 2002). The Park's sportfish database was used to evaluate adult fish populations in Florida Bay, and linked to environmental parameters such as rainfall and upland well levels.

An analysis of the fisheries database was undertaken as part of a request from National Marine Fisheries Service (NMFS) Protected Fisheries Division, (St Petersburg) to document the abundance of the smalltooth sawfish in SW Florida. It was found that in the vicinity of the park's coastal waters, this area serves as the last U.S. stronghold for the species. And based on a NMFS report (Status Review of smalltooth sawfish, *Pristis pectinata*), the species was recommended for inclusion as a candidate species covered by

the Endangered Species Act. Smalltooth sawfish tagging studies have been implemented in park waters to monitor their movement and abundance. The sawfish database was also provided to J. Seitz of the Collier County Dept. of Natural Resources to further document recent occurrences of sawfish along the southwest coast of Florida (Seitz and Poulakis, 2002).

Continuing conceptual model development for various coastal CERP (Comprehensive Everglades Restoration Project) projects identified interactions between ecosystem dynamics and higher trophic levels in Florida Bay and adjacent marine waters, focusing, in part, on adult spotted seatrout and snook catch rates. Various Federal/State interagency meeting participants identified draft ecological performance measures as indicators of ecosystem restoration. Snook and spotted seatrout CPUE are under development as performance measures for both the Florida Bay/Florida Keys and Southwest Florida Feasibility studies and, along with other recreationally important species, will be considered in the CERP evaluation /decision making process.

Other project-related activities in support of other South Florida National Parks for the lead author included: providing assistance in the development of draft fisheries desired future conditions (DCF) for Biscayne National Park (BNP). These activities are part of an ongoing process to develop a Fishery Management Plan (FMP) with the Florida Fish and Wildlife Conservation Commission (FFWCC) for BNP. In addition, a final report on baseline multispecies coral reef fish stock assessments for DRTO and the Dry Tortugas region was co-authored (Ault et al., 2001). The report described pristine to near-pristine conditions potentially threatened by over-fishing and habitat degradation.

A health advisory remains in effect for five species of marine fish found in northeastern Florida Bay. The average mercury level of spotted seatrout, gafftopsail catfish, crevalle jack, ladyfish, and bluefish is in excess of the state limit for human consumption.

This is the eighth fisheries report produced since 1990. Due to severe personnel shortages, only basic data collection activities were maintained from 1991-1994 by port samplers at Flamingo and Everglades City. This report includes a description of the fishery, relative abundance, and average size of the four major catch species in 2002, as well as comparisons with previous years. In addition, estimated total catch/harvest, effort, and boating activity are included, as well as environmental effects on cpue from 1985-2002.

METHODS

Methods (data collection/recording format) employed to obtain sport fishing monitoring and boating activity data in ENP have been previously presented by Higman (1967), Davis and Thue (1979) and Tilmant et al. (1986), and are briefly discussed below.

Recreational fishermen are interviewed at boat launch sites (Flamingo and

Chokoloskee/Everglades City) upon completion of their trip every weekend. Data recorded includes area fished (Figure 1), fish kept and released, effort (in angler-hours), species preference, angler residence, and fish lengths. Professional guides are required to obtain an annual permit from the park and report their monthly catch and effort on a per trip basis via logbooks supplied with the permit. Prior to 1980, reporting was voluntary. Reporting compliance of the guide fishermen is determined from recorded field observations by park rangers and by port samplers at the boat launch sites. Since the elimination of commercial fishing in ENP in 1985, only recreational guided and non-guided recreational anglers are permitted to fish within park waters.

Daily estimates of the total number of fishing boats operating in park waters were made by regressing the daily counts of empty trailers at Flamingo against a known number of boats fishing the same day. Aerial surveys were used to determine the correlation of boat trailers at the Flamingo launch ramp to the total number and distribution of boats within the park. Over 243 flights were conducted using randomly selected weekdays and weekends stratified by month for three sample periods (July 1972 to May 1975; October 1977 to October 1978; and October 1983 to October 1984). Highly significant linear relationships between the number of trailers at Flamingo and total boats observed in the park were obtained during each sampling period. The accuracy of the aerial observers was about 94% (152 known patrol boats on the water, 143 sighted). No significant differences were found among the regression statistics for the three survey periods and therefore all the data were pooled to strengthen the expansion estimates ($r=0.84$, $N=243$, $p<0.01$) (Tilmant et al. 1986). There was no significant difference in the boat count-trailer count regression between weekdays and weekends. The percentage of recreational boats actually fishing was determined from boater interviews.

Flamingo is by far the greatest single access point to Florida Bay and has been used by 50-60% of the total anglers. During 1972-1974 and 1981-1984, additional interviews were obtained at ramp sites along the Florida Keys. However, no significant differences were found in the catch composition or catch rate of these anglers when compared to those anglers fishing the same areas interviewed at Flamingo (Tilmant et al. 1986). Catch data from Area 6 is almost entirely from Chokoloskee/Everglades City interviews.

Estimates of total recreational catch and harvest of individual fish species for the non-guided fishery were determined by applying the recorded mean catch (or harvest) of that species per successful trip to the estimated total number of fishing trips successful for that species. The estimated total number of recreational fishing trips for a species was determined by applying the proportion of recreational boats contacted by interviewers, that were successful for the species, to the estimated total recreational boats determined by the ramp boat-trailer count. Statistical differences were found between Everglades City (Area 6) and Flamingo (Areas 1-5); therefore, total estimated catch and harvest computations were made separately for the Everglades City and Florida Bay regions and then added to obtain parkwide estimates (Tilmant et al. 1986).

Estimates of total harvest for the guide fishery were obtained by dividing the reported

harvest by the estimated percent reporting compliance of guides known to be fishing. Not all guides reported their catch as required; therefore, a reporting compliance adjustment was necessary. The estimate of reporting compliance as determined through independent field observations of fishing activities was about 39% in 2002.

The mean annual catch rates (CPUE) and harvest rates (HPUE) were calculated after Malvestuto (1983). Only those anglers successful in catching a species were used to calculate a catch or harvest rate to avoid bias in the possible change in the proportion of effort applicable to a species each year.

Statistical procedures used in previous years included tests for the assumptions of normality (Kolmogorov-Smirnov test) and homogeneity (Bartlett's Box F). When these assumptions were met a parametric one-way ANOVA or t-test was used to test differences in catch rate by fishery and area. If conditions of homogeneity or normality were not met after transformations, a non-parametric Kruskal-Wallis test was used instead of the ANOVA. After significance was determined ($p<0.05$), a Student-Newman-Keuls test or Dunn's multiple comparison test was used to identify particular differences.

Fish lengths taken from sport (non-guided) anglers in 2002 were analyzed to determine if there were differences among fishing areas and seasons. When the assumption of homogeneity of variances (Levene's test) was met, a parametric one-way ANOVA (f) was used to test differences in mean harvest length by area and season. If a significant difference was detected for an ANOVA ($p<0.05$), a Tukey's multiple comparison test was used to test for particular differences. To identify better relationships between fish catch and environmental conditions, additional site-specific catch locations have been used in the angler surveys. Results will be presented in a future report.

RESULTS

All of the non-guided angler catch data for Florida Bay and the immediately adjacent waters (Cape Sable, Whitewater Bay, and Shark River area, hereafter referred to as Florida Bay) has come from interviews conducted at the Flamingo boat ramps. All of the non-guided catch data for Everglades City (Lostman's River to the northwestern boundary of the park near Chokoloskee) has come from interviews conducted at the Everglades City-Chokoloskee boat ramps and marinas.

During 2002, 2917 boaters were interviewed at Flamingo. About 98% of these boaters were involved in sportfishing activity. Only 4.8% of the anglers did not catch fish.

At Everglades City, 2207 boaters were interviewed. Over ninety two percent of the total boats interviewed were fishing. Only 5.7% of the fishermen did not catch fish.

Description of the Fishery (2002)

Most (84.0%) of the anglers fishing out of Flamingo were South Florida residents (Dade County to Ft. Lauderdale, excluding local residents); 2.1% were local residents (Florida City, Flamingo, and the Florida Keys); 12.4% were Florida residents from the rest of Florida. Only 1.5% of the anglers came from out of state.

Most (87.0%) of the anglers fishing out of Everglades City were Florida residents, excluding south Florida and local residents. South Florida (Dade and Broward counties) accounted for 2.3% of the anglers, while 9.5% were local (Chokoloskee/Everglades City) residents and 1.2% came from out of state.

An estimated 29,543 fishing trips, 71,261 anglers, and 30,177 boats made up the boating and fishing activity in Florida Bay. Of these fishing trips, 9.67% were interviewed at the Flamingo boat ramps. The average trip lasted 7.31 hours with an average fishing time of 6.12 hours and an average of 2.41 anglers on board.

Most anglers interviewed at Flamingo (63.7%) did not try to catch any one specific kind of fish. Red drums were the most popular fish, sought by 10.5% of the fishermen; snook were sought by 9.8% of the fishermen. The next three species preferred were spotted seatrout (7.3%), tarpon (3.3%), and gray snapper (1.5%). Approximately 52% of the fishing parties interviewed in 2002 reported catching spotted seatrout (Figure 4). The next four species most commonly caught were gray snapper (37.9%), red drum (32.9%), snook (25.6%), and tarpon (4.3%).

At Everglades City, an estimated 16,628 fishing trips, 38,222 anglers, and 18,015 boats made up the boating and fishing activity. Of these fishing trips, 12.24% were interviewed at the Everglades City/Chokoloskee boat ramps. The average trip lasted 7.06 hours with an average fishing time of 5.7 hours and an average of 2.3 anglers on board.

Most anglers interviewed at Everglades City (66.2%) did not try to catch any particular

species of fish. Snook was by far the most popular fish, sought by 23.4% of the fishermen. The next four species that were preferred by anglers were red drum (4.4%), spotted seatrout (4%), tarpon (0.6%), and gray snapper (0.4%). More than 40.6% of the fishing parties interviewed in 2002 reported catching snook (Figure 4a). The next four species most commonly caught were spotted seatrout (36.0%), red drum (26.8%), gray snapper (22.4%), and tarpon (3.1%).

There were an estimated total of 46,171 fishing trips in park waters during 2002. This represents a decrease from the 49,066 fishing trips in 2001. The overall trend in recreational fishing trips since 1972 shows high values in 1973-75, with lows in 1979-80, and a rebound in the mid-80's to the third highest value in 1989 (Figure 2). A decline during 1992 is attributed to the impacts of Hurricane Andrew, when the park was closed from September through December. There was an increasing trend from 1993 until 1997, which had the second highest number of fishing trips recorded in ENP. The number of fishing trips generally stayed the same between 1998 and 2000, but showed a large increase in 2001 (Figure 2). The estimated number of fishing trips in 2002 declined from the all-time high in 2001 (Figure 2). The recreational fishing effort (total estimated angler-hours) has followed this same general trend from 1972-2002 as well (Figure 3).

Relative Abundance (CPUE and HPUE)

Catch rate is a function of the number of fish caught per unit of time or effort expended. The number of fish caught for each hour of fishing is used as an index of the abundance of the fish. The 2002 mean catch rate (CPUE) and harvest rates (HPUE) for the 11 major species of the recreational (non-guided) fishery in Florida Bay (Areas 1-5), Everglades City (Area 6), and all of ENP (Areas 1-6) are given in Table 1. Table 2 gives the mean catch and harvest rates of the six major species caught by guided anglers in Florida Bay (Areas 1-5), Everglades City (Area 6), and all of ENP (Areas 1-6). The relationships of 2002 non-guided catch and harvest rates to past years are presented in Figures 5-6 for the four major species (snook, red drum, spotted seatrout, and gray snapper). The relationships of 2002 guided catch and harvest rates to past years are presented in Figures 7-8 for six major species (snook, red drum, spotted seatrout, gray snapper, tarpon, and bonefish).

Estimated Total Catch and Harvest

The catches of the interviewed recreational anglers and the reported catches of the guide fishermen are only samples of the total park harvest. Catch rates calculated from interviews are multiplied by the estimated total number of boats fishing for a particular species to yield estimates of total non-guided catch and harvest. For the guided fishery, the total number of fish reported caught/harvested is divided by the percent guide compliance to yield the estimated total catch/harvest by species. The 2002 estimated total non-guided and guided catch/harvest (# of fish) is shown in Table 3. The relationships of 2002 catch and harvest to previous years are shown in Figures 9, 9a, 9b, and 10.

Recent Trends (Florida Bay, Everglades City, and Parkwide as noted)

Overall, 2002 annual guide and non-guided successful catch rates for snook, gray

snapper, spotted seatrout, and red drum were nearly as high or higher than recent years. Annual harvest rates for the four major species had been decreasing steadily since the middle to late 1980's, but seem to be holding steady in recent years. Catch rates may be used as an index of abundance and are directly related to environmental factors, but they are not directly affected by fishing regulations, while harvest rates most certainly are.

Snook

The popularity of snook has increased dramatically in recent years. Nearly 41% of licensed anglers in Florida have snook stamps (Muller and Murphy, 2002). The percentage of fishing parties catching snook in Florida Bay increased from 9% in 1985 to nearly 27% in 1994, but suffered a slight decrease through 2000 (Figure 4). The percentage of fishing parties catching snook increased to an all-time high of 28.1% in 2001 and slightly decreased to 25.6% in 2002. The percentage of fishing parties catching snook in Everglades City (Area 6) since 1995 decreased to a low of 36% in 1998 and increased to an all-time high of 44.9% in 2001, while only making a slight decline in 2002 to 40.6% (Figure 4a).

In 2002 an agreement was entered between FMRI and ENP for conducting an annual assessment of the condition of Florida's snook stocks. A grant to ENP in the amount of $2,500 was received from Mr. Howard Wells of the Snook Foundation to help develop the modification of the format for fisheries data. The format for the fisheries data will serve as a model for future innovations in collecting and analyzing information on the catch and harvest of Florida's recreational fishes. In the Park, from regularly visited boat ramps and marinas, project personnel have collected in addition to catch-effort and length data, sex and otoliths from snook caught by returning snook anglers. The goal of this new initiative is to provide stock assessors with data about the proportions of different sizes of snook that were caught and released. In the past, snook that had been caught, released, and unseen by the port samplers, were assumed to be of equal size as the snook that were legally harvested. There was also no information on sex of the fish harvested and no information on the size of the fish released. Since about 95% of the snook that are caught are released, and because of strict bag and size limits, the size and sex of the fish released have a large effect on the condition of the stock. If for example more female fish larger than 34" are released, then more larger (older) females in the population will provide greater reproductive output. Increased knowledge about the proportions of released snook will provide management with annual indices of recruitment of various cohorts, especially of the size of and year class that will enter the fishery next year. Because of these innovations in data collection, facilitated by the grant from the Snook Foundation, various fishery resource agency stock assessors will have access to those kinds of descriptive information.

Catch/Harvest Rates:

Harvest rates for both sport and guide fishermen in ENP have been relatively stable since 1980 (Figures 5, 6 and 7). Harvest rates in Florida Bay dramatically decreased in 2002 to an all time low of .08 snook/angler-hour primarily due to new regulations only allowing

anglers to harvest one snook/person/day and a new closed season for snook beginning May 1 instead of June1 (Figure 5). Harvest rates for all of ENP (Areas 1-6) also were at all time lows in 2002 (Figure 6), while harvest rates for guided anglers was relatively unaffected by the new regulations (Figure7). Guide catch rates have been relatively stable since 1996 (Figure 7). Catch rates for non-guided anglers in Florida Bay have shown a cyclical trend every eight years (Figure 5). There was a low in catch rates in 1980 that increased to a high in 1984. Catch rate then decreased to 0.171 fish per angler-hour in 1988, only to increase to another high in 1992 of 0.326 fish per angler-hour. Another low was reached in 1997 (0.217 fish per angler-hour), then catch rate started to increase yet again in 1998 with a value of 0.229 fish per angler-hour. The trend continued in 2000 with another high of 0.2968 fish per angler-hour and followed by slight decreases in 2001 and 2002. According to this trend in snook catch rates for the last 22 years, there will presumably be another 1-2 years of slightly declining catch rates before beginning an upward trend for the next four years, commencing with another peak in 2008.

These trends are corroborated by stock assessments conducted by FMRI (St. Petersburg) using state and federal recreational fishery statistics (Muller and Murphy, 2002). The increases may reflect stock recruitment of small juvenile snook, which were released in prior years because of size restrictions and were recruited to the fishery four years later; that is the time needed for snook to recruit to the park fishery (Thue et al, 1982). Snook are a relatively non-migratory, inshore species that will make localized movements between estuaries as juveniles and move to nearby offshore areas as adults for spawning. Increased rainfall and/or runoff may have also enhanced recruitment. Another snook stock assessment is planned to commence in 2005.

Estimated Total Catch & Harvest:

Recreational (non-guided) angler harvest in Florida Bay (Areas 1-5) has remained relatively stable throughout the period of record, despite bag limit restrictions that began January 1, 2002 (Figure 9). Estimated total catch for snook in Florida Bay has fluctuated in recent years, however has remained relatively constant since 1991 (Figure 9). Yet more fishermen are targeting the species than ever before; this would indicate that the Florida Bay stocks might have been overfished in the recent past (Muller and Murphy, 2002). While an analysis of total catch and harvest for Area 6 (Figure 9a) and Areas 1-6 (Figure 9b) in the most recent years (1998-2002) has shown a general increase in total catch and stable numbers in total harvest for snook through 2001, there were decreases in both total catch and harvest estimates in 2002. Guided anglers' total catch and harvest in Florida Bay had been increasing since 1990, but dropped after an all-time high in 1995 (Figure 10). The guided total catch and harvest estimates have been somewhat stable in recent years, however 2002 total harvest estimates reflected the lowest numbers since 1990-1991 (Figure 10).

Red Drum

The percentage of fishing parties catching red drum in Florida Bay decreased dramatically from 33% in 1985 to 17% in 1988 when the fishery was closed due to

overexploitation (Figure 4). When harvest was reopened, the percentage of anglers catching the species increased steadily to a 14 year high in 1997 of 36% (Figure 4). Although the percentages of anglers catching red drum decreased in proceeding years to 27.2% in 2000, an upward trend has occurred in the past two years. The percentage of fishing parties catching red drum in Everglades City (Area 6) was gradually declining between 1995 (a high of 36%) and 2000 (a low of 24.6%), followed by slight increases in 2001 and 2002 (Figure 4a).

Catch/Harvest Rates:

Red drum harvest rates for sport fishermen in Florida Bay (Figures 5) and in all of ENP (Figure 6) have remained quite stable beginning in 1989 when bag limits of 1 fish per person were imposed. Guide harvest rates in Florida Bay also have been quite stable since the 1988 closure (Figure 7). Increased size limits (12" to 18") and a closed season imposed on the fishery in September 1985 probably accounted for the large declines in harvest rates after 1985; however, the sharp decline during 1985 suggests the possibility of overharvest or poor recruitment (Figures 5 and 7). Meanwhile, sport fishermen catch rates in Florida Bay had been increasing since there was a low of 0.290 fish per angler-hour in 1994 to 0.384 fish per angler-hour in 1998. There has been a slight decrease each year since 1998 from 0.370 fish per angler-hour in 1999 to an all time low of 0.2724 fish per angler-hour in 2002 (Figure 5). Since the fishery recovered faster than anticipated, the Florida Marine Fisheries Commission (FMFC) allowed year-round fishing in 1996, which may explain the higher catch rates in the late 1990's. However, it should be noted that guide catch rates have shown a steady declining trend in the years between 1985 and 1995, although the catch rates have remained relative constant since a marked decline 1998 (Figure 7). Concurrently, guide harvest rates have also were fairly constant since 1998 (Figure 7) and have, in general, since 1989.

Estimated Total Catch & Harvest:

Annual estimated total catch data from non-guided fishermen suggests that red drum catches in Florida Bay had been steadily increasing from 1988 until 1997 (Figure 9). Since 1997, there were large decreases in total catch for 1998 and 1999 and total catch leveled off in 2000 (Figure 9). While 2001 total catch estimates were the highest during the period of record (43,656 fish), 2002 total catch declined considerably to an estimated 31,328 fish. The same trend for estimated total harvest show this pattern in 1998-2002 (Figure 9). Total estimated harvest of red drum in Florida Bay by guide fishermen has also shown a slow, but steady increasing trend from 1990 to 1998, and has remained relatively constant since (Figure 10). The estimated total catch for guides increased from 1990 until 1997 and have gradually declined since then (Figure 10). An analysis of the total catch of red drum by non-guided anglers at Everglades City (Area 6) showed a gradual decrease in 1998-2000, followed by a significant increase in 2001 and a significant decrease in 2002 (Figure 9a). The harvest rates follow these trends as well, but remain relatively stable. For the entire ENP (Areas 1-6), similar trends in the total catch and harvest of red drum between 1998 and 2002 were seen as well (Figure 9b).

Spotted Seatrout

The percentage of fishing parties interviewed at Flamingo (Areas 1-5) catching seatrout declined slightly from 1985-1989, but increased sharply to a 18 year high in 1992 of almost 65% (Figure 4). Since then, the percentage of anglers catching seatrout declined to a 18 year low in 1996 of 39% (Figure 4). The trend had been increasing since 1996 with seatrout caught by over 58% of the anglers in 2000, until slight decreases to in 2001 and 2002 were seen (Figure 4). The percentage of fishing parties interviewed at Everglades City (Area 6) that were catching spotted seatrout since 1995 has not shown a significant trend and ranges between 30% (1995) and 42.9% (2000) (Figure 4a). On January 1, 1996, state seatrout regulations implemented several restrictions that affected seatrout harvest rates (Figures 5, 6, and 7) and total estimated catch and harvest (Figures 9 and 10). Regulations in 1996 prohibited harvesting seatrout during November and December each year, raised the minimum size limit from 14" to 15", and allowed only 1 fish/person/day larger than the maximum size limit of 20". Seatrout catch and harvest rates (Figures 5, 6, and 7) and total estimated catch and harvest (Figures 9 and 10) were presumably affected from 2000 to 2001 due to a new regulation in July 2000 reducing the bag limit from 5 fish/person/day to 4 fish/person/day. Fishing regulations may have affected angler strategy, as the declining trend in seatrout is associated with increases in red drum and snook fishing. Fishermen may have switched their targeting preference to the latter two species when their numbers increased after changes in regulations.

Catch/Harvest Rates:

Sport fishermen harvest rates for seatrout have been holding steady since 1990 in Florida Bay (Figure 5) and in all of ENP (Figure 6) however there is a decreasing trend in the past two years. Guide harvest rates, on the other hand, have been gradually decreasing since 1982; yet, guide catch rates have been fluctuating over the same time period (Figure 7). The catch rate of sport fishermen in Florida Bay has also fluctuated throughout the period of record, however significant decreases in catch rates in 2001 (0.8395 fish/angler-hour) and 2002 (a 23-year low of 0.6835 fish/angler-hour) have been noted (Figure 5). The catch rate of seatrout in all of ENP has been relatively stable since 1990, however 2002 saw a 13-year low of 0.6291 fish/angler-hour (Figure 6). Harvest rate of spotted seatrout also was at a 13-year low of 0.2356 fish/angler-hour in 2002. The lack of increase in harvest rate associated with an increase in catch rate may be due to state regulations imposed on the fishery in 1989 which raised the legal size limit from 12" to 14", and then for the south Florida populations to 15" in 1996 (Figure 5). These regulations were meant to reduce harvest to achieve the FMFC's spawning potential ratio (SPR) objective of 35%. The SPR is the ratio of the spawning stock biomass of the exploited fish population to the spawning stock biomass of the same population in an unfished condition.

Estimated Total Catch & Harvest:

Annual estimated total harvest data from non-guided fishermen in Florida Bay suggests that seatrout harvest decreased steadily from 1989 to 1996 (Figure 9). Since 1997, the estimated number of fish harvested has remained relatively stable. There has been an upward trend in the estimated catch since a low in 1996 (Figure 9). The estimated total catch and harvest for Everglades City (Area 6) and all of ENP (Areas1-6) between 1998

and 2002 show gradual increases until 2000; there have been slight decreases in 2001 and 2002 (Figures 9a & 9b). Estimated total harvest from guide fishermen in Florida Bay had been very stable from 1990-1995, but experienced an all time low in 1996. Since 1996, seatrout total harvest rebounded to 16,002 fish in 2000, but has decreased in both 2001 (8894 fish) and 2002 (8226 fish) (Figure 10). Meanwhile, the estimated total catch of seatrout by guided fishermen had shown an increasing trend since 1990 (excluding 1996), with an all time high of 103,098 fish in 2000 (Figure 10). However, the 2001 estimated total catch (65,994 fish) showed marked decline from the 2000 numbers, while the 2002 estimated total catch increased to 76,894 fish.

Gray Snapper

The percentage of fishing parties reporting catches of gray snapper in Florida Bay has remained relatively stable from 1985-2002 (Figure 4). The large decline seen in 1991 was probably due to new regulations that established the minimum size at 10" with a bag limit of five fish per person. Recently, the percentage of anglers catching gray snapper has been increasing from 29% in 1997 to nearly 38% in 1999. In 2000 there was an all time low of 27.9% of fishing parties catching gray snapper, but rebounded to 33% in 2001 and increased further to 37.9% in 2002 (Figure 4). The percentages of fishing parties interviewed at Everglades City (Area 6) that were catching gray snapper have remained very stable since 1995 (Figure 4a).

Catch/Harvest Rates:

In general, sport and guide harvest rates in Florida Bay (areas 1-5) for gray snapper have shown steady declines since 1980 (Figures 5 and 7). Sport and guide catch rates have been fluctuating through the period of record, however catch rates have been lower for the most recent years (Figures 5, 6, and 7). After a steady decline from 1992 to 1998, the catch rate for sport anglers jumped to 0.892 fish per angler-hour in Florida Bay in 1999 (Figure 5). During 1988-1992, the increase in catch rate, and a lack of an increase in harvest rate of sport anglers, may reflect good recruitment of small juvenile fish to the stock. Perhaps the large increase in catch rate in 1999 is also related to good recruitment.

Estimated Total Catch & Harvest:

During the 1990's, the annual guide and non-guided estimated total catch and harvest for gray snapper in Florida Bay has dropped as low or lower than anytime during the previous record (Figures 9 and 10). While the estimated catch of sport anglers in Florida Bay experienced large increases from 1997-1999, there was a marked decline in 2000 (Figure 9). The low total harvest is probably due to regulations imposed on the fishery in 1988 and 1990 when the legal minimum size was increased from 6" to 8" and then to 10" with a bag limit of 5 fish per person. However, harvest rates since 1991 have remained relatively stable (Figure 9). Estimated total catch for gray snapper shows an almost cyclic 3-year trend since 1990 (Figure 9). This is no surprise since gray snapper in Florida Bay take approximately 3-4 years to be recruited into the fishery. The estimated total catch and harvest of gray snapper in Everglades City (Area 6) showed a marked decrease from 1998 to 1999, however have remained relatively stable since (Figure 9a). In contrast, estimated total catch and harvest throughout all ENP (Areas 1-6) gradually

decreased from 1998 to 2000. Total estimated catch has slightly increased in 2001 and 2002, while total estimated harvest increased in 2001 and slightly decreased in 2002 (Figure 9b).

Tarpon & Bonefish

The professional guide fishery is largely directed at a few highly prized gamefish species. Two of these species, tarpon and bonefish, are of little food value and are not sought by the majority of the non-guided anglers. They are the trophy species of the guide fishery. Since harvest of tarpon only occurs for the purposes of mounting the catch, catch rate is more indicative of the stock than harvest rate.

The catch rate of tarpon rebounded in 1983, from a low in 1982, but experienced a slow decline in the mid-1980's reaching another low in 1987 (Figure 8). The cpue (catch rates) of tarpon increased to an all-time high of 0.254 fish per angler-hour in 1995 and then leveling off around a somewhat lower cpue of approximately 0.20 fish per angler-hour in the following years (Figure 8).

Like tarpon, bonefish are not harvested unless the angler desires to mount the catch. Bonefish catch rates show an almost cyclic trend since 1980, with a low value in 1983, steadily increasing through the late 1980's, reaching another low in 1992 (Figure 8). Guide catch rates for bonefish reached an all-time high in 1994 only to decline again for the period of 1995-2000 (excluding 1997). Catch rates for bonefish have stayed relatively stable for the past four years (1999-2002), but reached an all-time low of 0.2308 fish/angler-hour in 2000 (Figure 8). Nearly all bonefish are caught in Area 2 and are released when caught; therefore, it is highly unlikely that fishing mortality has played any significant role in determining bonefish stock abundance. The annual estimated total catch of tarpon and bonefish for guided anglers in 2002 is given in Table 3.

Fish Lengths (2002)

Snook

A comparison of mean lengths of harvested snook in Areas 1, 3, 4, 5, and 6 (Area 2 was not included in the analysis due to insufficient data) showed that there was not a significant difference in mean lengths among the five areas in 2002 (df=285, f=1.201, p=0.311) (Figure 11). The lengths for Areas 1-5 were pooled together to determine if there was a difference in the lengths of snook harvested in Florida Bay (Areas 1-5) versus Everglades City (Area 6). For 2002, there was no difference in mean snook length between Florida Bay and Everglades City (df=285, f=0.134, p=0.715) (Figure 12).

A parkwide seasonal comparison of snook lengths for 2002, showed that there was a significant difference among the four seasons (df=285, f=4.344, p=0.005) (Figure 13). Using Tukey's multiple comparison test, snook harvested in the summer (July-September) were significantly longer than those harvested in winter (January-March) or fall (October-December) (Figure 13). In 2002, a comparison of snook lengths from Florida Bay only (Areas 1-5) showed that there was a significant difference in the length

of harvested fish among the four seasons (df=175, f=2.99, p=0.033) (Figure 14). Using Tukey's multiple comparison test, snook harvested in the summer were significantly longer than those harvested in fall (Figure 14). We also found that there was a significant difference in the lengths of harvested snook among the four seasons in (Area 6) Everglades City (df=109, f=3.48, p=0.019) (Figure 15). Using Tukey's multiple comparison test, snook harvested in the spring were significantly longer than those harvested in winter (Figure 15).

Red Drum

There was a significant difference in the mean lengths of red drum harvested among the six areas of ENP during 2002 (df=598, f=2.782, p=0.017) (Figure 11). On average, using a Tukey's multiple comparison test, red drum harvested from Area 1 were significantly longer (p=0.003) than the red drum taken from Area 4 (Figure 11). The lengths for Areas 1-5 were pooled together to determine if there was a difference in the lengths of red drum harvested in Florida Bay (Areas 1-5) versus Everglades City (Area 6). In 2002, there was not a significant difference in the lengths of red drum harvested in Florida Bay versus Everglades City (df=598, f=0.167, p<0.683) (Figure 12).

A seasonal comparison of red drum lengths parkwide (Areas 1-6) showed that there was a significant difference in the lengths of red drum in 2002 (df=598, f=4.344, p=0.005) (Figure 13). Using Tukey's multiple comparison test, red drum harvested in the winter were significantly shorter than those harvested in summer or fall (Figure 13). The lengths of red drum harvested in Florida Bay only (Areas 1-5) showed significant seasonal differences (df=338, f=3.584, p=0.014) (Figure 14). Using Tukey's multiple comparison test, red drum harvested in the summer were significantly longer than those harvested in winter (Figure 14). Similarly, red drum harvested in Everglades City (Area 6) also showed a significant difference among seasons (df=259, f=3.822, p=0.011) (Figure 15). However, using Tukey's multiple comparison test, we found that red drum harvested in the fall were significantly longer than those harvested in winter (Figure 15).

Spotted Seatrout

In 2002, there was not a significant difference in the mean lengths of harvested spotted seatrout among the six areas of ENP (df=1531, f=1.363, p<0.236) (Figure 11). When the lengths for Areas 1-5 were pooled together to determine if there was a difference in the lengths of spotted seatrout harvested in Florida Bay (Areas 1-5) versus Everglades City (Area 6) during 2002, there was not a significant difference (df=1,531, f=0.000, p=0.992) (Figure 12). In addition, there was a significant difference in the mean lengths of spotted seatrout harvested parkwide (Areas 1-6) among the four seasons in 2002 (df=1,531, f=6.938, p<0.0001) (Figure 13). Using Tukey's multiple comparison test, trout harvested in the spring (April-June) were significantly longer than those harvested in winter or summer (Figure 13).

A seasonal comparison of spotted seatrout harvested only in Florida Bay (Areas 1-5) showed that there was not a significant difference in the lengths of seatrout harvested among the four seasons of the year (df=758, f=2.38, p=0.068) (Figure 14). There was a

significant difference found in the lengths of spotted seatrout harvested in Everglades City (Area 6) during the four seasons of 2002 (df=772, f=7.447, p<0.0001) (Figure 15). Using Tukey's multiple comparison test, seatrout harvested in the spring were significantly longer than those harvested in winter or summer (Figure 15).

Gray Snapper

In 2002, there was a significant difference in the lengths of harvested gray snapper among the six areas of ENP (df=769, f=28.113, p<0.0001) (Figure 11). The gray snapper that were harvested in Area 3 were significantly longer than ones harvested from Areas 1, 4, 5, and 6 (Figure 11). In addition, the gray snapper that were harvested in Area 1 were significantly shorter than those harvested in Areas 2, 3, 4, and 5 (Figure 11). The lengths for Areas 1-5 were pooled together to determine if there was a difference in the lengths of gray snapper harvested in Florida Bay versus Everglades City (Area 6). Indeed, gray snapper harvested from Areas 1-5 were significantly larger than those harvested in Area 6 (df=769, f=48.351, p<0.0001) (Figure 12).

There were significant differences in the size of gray snappers harvested parkwide (Areas 1-6) among the four seasons in 2002 (df=769, f=6.932, p<0.0001) (Figure 13). Using Tukey's multiple comparison test, snapper harvested in the summer were significantly longer than those harvested in spring or fall (Figure 13). Similarly, gray snapper lengths in Florida Bay only (Areas 1-5) were significantly different among the four seasons (df=525, f=7.265, p<0.0001) (Figure 14). Using Tukey's multiple comparison test, snappers harvested in the summer were significantly longer than those harvested in spring or fall (Figure 14). However, harvested gray snapper in Everglades City (Area 6) showed no significant seasonal differences in lengths during 2002 (df=243, f=0.627, p=0.598) (Figure 15).

<u>Environmental Relationships</u>

Catch rates are directly related to environmental factors such as rainfall, water level, and salinity. The catch rates for sport (non-guided) fishermen were correlated with rainfall, water level, and salinity from 1985-2002 (Figures 16-19). Total annual rainfall from 1985-2002 was compiled and averaged from five stations within or near ENP (Flamingo, Royal Palm, Everglades City, Tamiami Ranger Station, and Tavernier. Butternut Key has replaced Tavernier since 1997). Water level data from 1985-2002 was obtained from well P-37 in western Taylor Slough. Salinity data from 1985-2002 was obtained from three stations in northern Florida Bay (Butternut Key, Taylor River, and Trout Cove).

Snook

The declines in snook stocks from 1985-1988 and from 1993-1997 may have been due to low rainfall and water levels in the upper marsh regions. There was not a significant correlation between water levels recorded and catch rates from 1985-2002 (r=0.28, N=18, p=0.26); this same result was obtained last year as well when 1985-2001 was analyzed. Although, no statistically significant correlation was found, the trends seen in Figure 16 suggest that a period of generally high salinity (r=-0.174, N=18, p=0.489) leads to a decline in the abundance of snook. Field studies on snook habitat have shown that the

greatest number of juveniles are consistently found in shallow, well protected, back-water areas of estuaries that are influenced by freshwater runoff (Fore and Schmidt 1973; McMichael et al. 1987). In addition, no significant correlation was found between rainfall and snook catch rates (r=0.146, N=18, p=0.564).

Gray Snapper

Overall (1985-2002), a positive significant (r=0.55, N=18, p=0.018) relationship was found between catch rates of gray snapper and mean annual salinities found in northern Florida Bay (Figure 17), suggesting that periods of high salinity may lead to increased abundance of gray snapper. Average annual water levels recorded at P-37 were significantly inversely related to gray snapper catch rates during the same year (r=-0.589, N=18, p=0.01), indicating that during periods of reduced water levels in the upper Taylor Slough the abundance of gray snapper increased. Rainfall was not significantly correlated with gray snapper catch rates (r=-0.378, N=18, p=0.122). Similar correlation results were obtained last year when data from 1985-2001 was analyzed. This leads to the theory that increases in gray snapper abundance may be related to low yearly rainfall in the ENP area and periods of high salinities in Florida Bay. A series of low rainfall years from 1985-1990 resulted in increased hypersaline conditions in Florida Bay. Rutherford et al. (1983) reported larger fish in areas of higher salinity. Thus, if during low rainfall years, sub-adult fish remain in Florida Bay longer under high salinity conditions, then gray snapper abundance (catch rates) should increase and the fish would become increasingly available to the angler. During the 1993-1995 period, water levels/rainfall increased, especially from Tropical Storm Gordon in November 1994, resulting in salinity reductions in northern Florida Bay with a notable decrease in gray snapper catch rates (Figure 17).

Spotted Seatrout

As salinity increased to a high in 1990, seatrout catch rates increased, and as salinities dropped in the proceeding years, 1992-1993, catch rates also decreased (Figure 18). However, there seems to be an inverse relationship between trout catch rates and salinities since 1993. There was no statistically significant relationship between the two variables from 1985-2002 (r=0.228, N=18, p=0.363). Rainfall and water levels also had no correlation with seatrout cpue (r=-0.1, N=18, p=0.692 and r=-0.135, N=18, p=0.594, respectively). These are the same results as last year when environmental parameters were correlated with cpue from 1985-2002. However, recent studies have suggested that increased rainfall/water levels improve recruitment through increased growth and survival of larvae and juvenile spotted seatrout (Thayer et al. 1998). Presumably an increase in coastal rainfall (and thus lower salinities) results in an increase in larval recruitment and/or juvenile survival (Rutherford et al. 1989a).

Red Drum

The reduced abundance of red drum during the late 1980's may have been due to a combination of prior intense fishing pressure and increased rainfall. Previous studies (Higman, 1967) have shown that low rainfall may lead to an increase in the abundance of

juvenile red drum. However, no statistically significant relationships were found between red drum catch rates and any of the environmental variables from 1985-2002 just as there were no significant correlations last year when only 1985-2001 was analyzed (Figure 19). There was no statistically significant relationship between the red drum catch rates and salinities from 1985-2002 ($r=0.375$, $N=18$, $p=0.125$). Rainfall and water levels also had no correlation with red drum cpue ($r=-0.335$, $N=18$, $p=0.174$ and $r=-0.226$, $N=18$, $p=0.367$, respectively).

Effort-Catch Relationships

It is not always sufficient to know if catch rates are declining to determine if a fishery is in trouble. If both total catch and catch rates are in decline, then there is a need to assess the amount of effort being placed on the fishery. In Figure 20, estimated total catch and estimated total effort of the four major species are correlated to determine if fishing effort impacted the stock.

Snook

Annual fishing effort of sport anglers catching snook in Florida Bay ranged a low of 26,775 angler-hours in 1985 to an all time high of 129,910 angler-hours in 2001 (Figure 20). The total estimated catch of snook from the sport fishery in Florida Bay increased from a low of 6,538 fish in 1986 to another all time high of 25,887 fish in 2001 (Figure 20) representing approximately a 67% increase from the number of fish caught in 2000. This was due to the concurrent increase in effort. In 2002, while effort (125,847 angler-hours) placed on the snook stock remained relatively equal to that in 2001, the total estimated catch decreased significantly to 18,841 fish (Figure 20). This suggests a cause for concern as less snook were caught per unit effort in 2002. However, with new snook regulation changes allowing only 1 fish/person/day to be harvested in ENP beginning in 2002 and the closed month of May with no fish over 34" permitted, harvest rates would certainly be affected. In 2002, there were less snook caught while exerting the same amount of effort as in 2001. Despite this, the annual estimated total catch of snook for the sport fishery was highly correlated with the estimated total effort placed on the stock between 1985 and 2002 ($r=0.894$, $N=18$, $p<0.0001$) (Figure 20). Total catch appeared to increase linearly over the entire range of annual effort, suggesting that current catches do not greatly impact the Florida Bay stock and that additional increases in catch may be possible. However, it should be noted that snook catches decreased dramatically in 1998 and 1999 after five years of good catches and a fairly high annual effort in 1997. Effective December 31, 1998, state regulations were revised to prevent further overfishing by increasing the minimum size from 24" to 26" and prohibiting the possession of snook over 34" while maintaining a two fish bag limit.

Red Drum

The total estimated recreational fishing effort for red drum in Florida Bay ranged from a low of 58,093 angler-hours 1988 to an all time high of 159,144 angler-hours in 2001 (Figure 20), which represents an increase over 2.5 times the fishing effort in 1988. Estimated effort dropped in 1998, 1999, and 2000, while the estimated catches of red

drum concurrently decreased also. A statistically significant linear relationship ($r=0.752$, $N=18$, $p<0.0001$) was found between yearly effort from 1985-2002 and the resultant catch, suggesting that the increase in fishing effort did not greatly impact the catch of red drum in the sport fishery (Figure 20). It should be noted that red drum catch decreased dramatically in 1999 to 29,678 fish after three years (1996-1998) of very good catches due to high fishing effort. The estimated catch of red drum again increased from the number of fish in 2000 (29,180) to those in 2001 (43,656 fish). However, since there was more effort in 2001, the estimated total catch of red drum was expected to increase also. It is a special concern that while the effort placed on the red drum stock in 2002 (157,121 angler-hours) remained relatively the same as in 2001 (159,144 angler-hours), the total estimated catch decreased significantly (from 43,656 to 31,328 fish) (Figure 20). This is a cause for concern since this indicates that less red drum were caught per unit effort in 2002. If we compare another year similar to that of the 2002 effort (1997 in this case was 154,227 angler-hours), you'd see that considerably more fish were caught per unit effort in 1997 (45,979 fish) than in 2002 (31,328 fish) (Figure 20).

Spotted Seatrout

The correlation of yearly estimated effort with estimated catch was linear and significant ($r=0.740$, $N=18$, $p<0.0001$) (Figure 20). Total estimated effort for spotted seatrout ranged from a record high of 249,199 angler-hours in 2001 to a low of 147,882 angler-hours in 1995 (Figure 20). In conjunction with the increased effort on spotted seatrout from 2000 to 2001, the estimated total catch decreased by about 10,000 fish. This type of trend indicates that yearly fishing effort may have impacted the fishery. For example, while the amount of effort in 2002 remained relatively the same as in 2001, the total estimated catch decreased substantially from 2001 (162,801 fish) to 2002 (136,278 fish) (Figure20). While these numbers represent only one to two years of data, the fishery should be able to rebound. We will closely review this trend in the next annual report.

Gray Snapper

Annual estimated effort for the non-guided gray snapper fishery ranged from a high of 187,276 angler-hours in 2002 to a low of 96,311 angler-hours in 1985 (Figure 20). The yearly catches of gray snapper were lowest in 1987 (58,401), 1985 (61,859), and 2000 (63,873) and highest in 1989 (123,707) and 1990 (122,327) (Figure 20). While effort barely increased from 138,807 angler-hours in 1998 to 140,705 angler-hours in 1999, the catch increased quite dramatically during the same time span from 77,267 fish in 1998 to 96,641 fish in 1999 (this is the third highest value during the period of record). Initially this indicates a good recruitment class in 1999, but the low estimated catch in 2000 suggests the contrary. The low estimated catch of snapper in 2000 is partially due to the lowest estimated effort (109,571 man-hours) since 1987. In 2001 and 2002, the estimated catch of gray snapper and the annual estimated effort both increased. The annual estimated total catch of gray snapper was linearly correlated with the estimated total effort placed on the fishery between 1985-2002 ($r=0.604$, $N=18$, $p<0.01$), suggesting that the maximum potential catch of gray snapper in Florida Bay has not been reached (Figure 20).

FUTURE WORK/MEETING RESULTS

While the current sportfish monitoring project is evaluating various aspects of catch/harvest rates, total estimated catch/harvest, and fishing/boating activity, additional areas of work are underway or are needed. These include: (1) updated in-house and FMRI stock assessments on major game fish species including snook, red and black drum, goliath grouper, and sheepshead (2) incorporating the fisheries database into the park's GIS system for spatially oriented ecological applications, (3) develop a new fishery data management handbook, and (4) as a result of increased computing power, a minor adjustment to catch and harvest rates will be done (catch and harvest rates will be calculated by fishing area, not interview location). A pilot creel census program at Dry Tortugas National Park was delayed due to funding constraints during 2001, and will be the focus of a resource monitoring plan for 2002, with a start-up planned in 2003.

Several collaborative, ongoing studies are underway with Fed/State fishery resource agencies. In a collaborative effort with the NMFS, SEFC, Miami, FL, the sport database in ACCESS was provided to fisheries personnel to analyze and synthesize with existing fisheries and environmental databases in order to develop statistical models relating species abundance to environmental conditions and different water management scenarios. This effort is part of the Interagency Florida Bay Strategic Science Plan's successful restoration of Florida Bay using the Higher Trophic Levels science program. The park's sport database was analyzed using non-parametric trend analysis and correlation analysis to detect long term changes in catch rate by individual fishing area. Some of the preliminary results were presented at the Florida Bay Science Conference. A paper was co-authored along with fisheries scientists from NOAA, USGS, and FFWCC on the abundance of fishes and macro-invertebrates in Florida Bay (Johnson and Browder, 2002). Adult fish populations in Florida Bay were linked to environmental parameters such as rainfall and upland well levels.

The National Marine Fisheries Service, Gulf States Marine Fisheries Commission, FMRI, and the NPS (ENP) worked cooperatively to develop the Gulf Charter Boat Survey Research Program. The Program is developing methods for more efficient data collection and more precise estimation of fishing effort by charter (guide) boat anglers. The program consists of two surveys - a telephone survey of charter boat operators and a logbook survey. In addition, FFWCC field intercept surveys continue to provide information for guided and private anglers to estimate angler catch using the existing NMFS estimates. Guide parties fishing in park waters during the week have also been interviewed at Chokoloskee to obtain information on their catch and fish measurements.

As a committee member, the semi-annual Fisheries Information Network (FIN),

Recreational Fisheries Information Network (RECFIN), Commercial Fisheries Information Network (ComFin), and Biological/Environmental Work Group meetings were not attended in 2002. Funding issues and priorities addressed included: NMFS/NPS surveys, night fishing pilot study results, tournament fishing, getting better data for stock assessments using a recreational biological samples (otolith) sorting center, establishing a central Gulf data processing center in Mississippi, metadata development, and acquiring funding for Gulf-wide data collection, processing, and dissemination.

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LITERATURE CITED

Ault, J.S. with 13 co-authors. 2001. Baseline multispecies coral reef fish stock assessment for the Dry Tortugas. Final report on CA5280-00-032 to Dry Tortugas National Park. 121 p.

Davis, G. E. 1979a. An Assessment of fishery management options in Everglades National Park, Florida. USNPS/SFRC/ P.O. Box 279, Homestead, FL, 33030.

Davis, G. E. 1979b. Changes in the Everglades National Park red drum and spotted seatrout fisheries, 1958-1978: Fishing pressure and environmental stress on natural cycles. In Porch (ed.) Colloquium on the biology and management of red drum and seatrout, p. 81-87. Gulf States Mar. Fish. Com.

Davis, G. E. and E. B. Thue. 1979. Fishery data management handbook. Rept. T-546. Everglades National Park, SFRC, P. O. Box 279, Homestead, FL. 33030.

Fore, P.L. and T.W. Schmidt. 1973. Biology of juvenile and adult snook, *Centropomus undecimalis*, in the Ten Thousand Islands. Ecosystem Analysis of the Big Cypress Swamp and Estuaries. EPA 904/9-74-002, U.S. EPA, Athens,GA.

Higman, H. B. 1967. Relationships between catch rates of sportfish and environmental conditions in Everglades National Park. Gulf Carib. Fish. Inst.19: 129-140.

Johnson, D. and J. Browder. 2002. A Meta-analysis and synthesis of existing information on higher trophic levels in Florida Bay. Final Report OPD-01/02-10. NOAA/SEFC to ENP, Homestead, FL.

Malvestuto, S. P. 1983. Sampling the recreational fishery. IN: L.A. Nielsen and D. L. Johnson (eds). Fishery Techniques. Amer. Fish. Soc., Bethesda, MD. p 397-419.

McMichael, R. H. Jr., K. M. Peters, and G. Parsons. 1987. Early life history of common snook, *Centropomus undecimalis*, in Tampa Bay, Florida. In: Proc.Third Snook Symposium. 1987. West Palm Beach, FL Florida Department of Natural Resources, Marine Research Lab, St. Petersburg, FL. 11 pp.

Muller, R. G., and M. D. Murphy. 2002. The 2002 stock assessment update of common snook, *Centropomus undecimalis*. Fish and Wildlife Conservation Commission, Florida Marine Research Institute. St. Petersburg, Florida. 50pp.

Rutherford, E. S., E.B. Thue, and D.G. Buker. 1983. Population structure, food habits, and spawning activity of gray snapper, *Lutjanus griseus*, in Everglades National Park. South Florida Research Center, Everglades National Park, Homestead, FL.

Report 83/02. 41pp.

Rutherford, E. S., J. T. Tilmant, E. B. Thue, and T. W. Schmidt. 1989a. Fishery harvest and population dynamics of spotted seatrout, *Cynoscion nebulosus*, in Florida Bay and adjacent waters. Bull. Mar. Sci. 44: 108-125

Rutherford, E. S., J. T. Tilmant, E. B. Thue, and T. W. Schmidt. 1989b. Fishery harvest and population dynamics of gray snapper, *Lutjanus griseus*, in Florida Bay and adjacent waters. Bull. Mar. Sci. 44: 139-154

Seitz, J.C. and G.R. Poulakis. 2002. Recent occurrence of sawfishes (Elasmobrachiomorphi: Pristidae) along the southwest coast of Florida (USA). Florida Sci. 65:4, 256-266.

Thayer, G.W., A.B. Powell and D.E. Hoss. 1998. Response of larval, juvenile, and small adult fishes to changes in environmental conditions in Florida Bay: a decadal comparison. Proc. Florida Bay Sci. Conf., Miami, FL.

Thue, E.B., E.S. Rutherford, and D.G. Buker. 1982. Age, growth, and mortality of the common snook, *Centropomus undecimalis*, in Everglades National Park, Florida. Report T-683. Homestead, FL, ENP, SFRC. 32pp.

Tilmant, J. T., E. S. Rutherford, R. H. Dawson, and E. B. Thue. 1986. Impacts of gamefish harvest in Everglades National Park. Pro. Conf. Sci. in Nat'l Parks. pp. 75-103.

Table 1. Recreational catch/harvest rates (fish per angler-hour) of non-guided (sport) anglers in Everglades National Park, 2002.

Non-Guide Anglers (Areas 1-5)				
Species	**CPUE ±95% Conf. Interval**	**HPUE ±95% Conf. Interval**	**Sample Size *** CPUE/HPUE	
Snook	0.2126± 0.0195	0.0822 ± 0.0065	835	181
Red Drum	0.2724 ± 0.0249	0.1071 ± 0.0049	1,003	549
Spotted Seatrout	0.6835 ± 0.0483	0.2345 ± 0.0149	1,533	783
Gray Snapper	0.6556 ± 0.0480	0.2713 ± 0.0238	1,109	508
Tarpon	0.1390 ± 0.0288	N/A	128	0
Black Drum	0.2762 ± 0.0501	0.2011 ± 0.0333	202	137
Sheepshead	0.2912 ± 0.0789	0.1806 ± 0.0355	246	151
Spanish Mackerel	0.2406 ± 0.0740	0.2090 ± 0.0617	143	109
Grouper	0.2219 ± 0.0318	0.1463 ± 0.1351	215	21
Ladyfish	0.4701 ± 0.0455	0.1599 ± 0.0402	1,169	30
Crevalle Jack	0.4163 ± 0.0297	0.1764 ± 0.0408	1,518	78
Non-Guide Anglers (Areas 1-6)				
Species	**CPUE ±95% Conf. Interval**	**HPUE ±95% Conf. Interval**	**Sample Size *** CPUE/HPUE	
Snook	0.2522 ± 0.0160	0.0938 ± 0.0075	1,559	310
Red Drum	0.2591 ± 0.0201	0.1076 ± 0.0044	1,486	806
Spotted Seatrout	0.6291 ± 0.0386	0.2356 ± 0.0128	2,215	1,198
Gray Snapper	0.7171 ± 0.0566	0.2739 ± 0.0220	1,538	636
Tarpon	0.1442 ± 0.0371	N/A	186	0
Black Drum	0.2679 ± 0.0477	0.1959 ± 0.0316	230	148
Sheepshead	0.2921 ± 0.0566	0.1671 ± 0.0254	402	224
Spanish Mackerel	0.2819 ± 0.1012	0.2336 ± 0.0625	235	171
Grouper	0.2148 ± 0.0239	0.1325 ± 0.1051	342	27
Ladyfish	0.4906 ± 0.0361	0.3157 ± 0.1217	1,967	72
Crevalle Jack	0.3954 ± 0.0215	0.1742 ± 0.0354	2,432	94

Table 1 (cont.)

Non-Guide Anglers (Area 6)				
Species	**CPUE ±95% Conf. Interval**	**HPUE ±95% Conf. Interval**	**Sample Size *** CPUE/HPUE	
Snook	0.2959 ± 0.0258	0.1086 ± 0.0151	719	127
Red Drum	0.2225 ± 0.0323	0.1086 ± 0.0093	479	256
Spotted Seatrout	0.5073 ± 0.0621	0.2377 ± 0.0241	678	415
Gray Snapper	0.8582 ± 0.1595	0.2834 ± 0.0554	424	127
Tarpon	0.1557 ± 0.1011	N/A	58	0
Black Drum	0.1330 ± 0.0965	0.1302 ± 0.0838	26	11
Sheepshead	0.2945 ± 0.0780	0.1397 ± 0.0256	153	72
Spanish Mackerel	0.3521 ± 0.2395	0.2797 ± 0.1361	89	61
Grouper	0.1984 ± 0.0346	0.0845 ± 0.0262	126	6
Ladyfish	0.5104 ± 0.0590	0.4313 ± 0.2057	784	41
Crevalle Jack	0.3593 ± 0.0286	0.1633 ± 0.0643	910	16

* Number of fishing parties.

Table 2. Average recreational catch/harvest rates (fish per angler-hour) of guided anglers in Everglades National Park, 2002.

Guide Anglers (Areas 1-5)				
Species	**CPUE ±95% Conf. Interval**	**HPUE ±95% Conf. Interval**	**Sample Size *** CPUE/HPUE	
Snook	0.2917 ± 0.0179	0.1035 ± 0.0066	1,178	259
Red Drum	0.3900 ± 0.0235	0.1187 ± 0.0047	1,516	555
Spotted Seatrout	1.6325 ± 0.0766	0.3962 ± 0.0218	1,790	564
Gray Snapper	1.6338 ± 0.1526	0.5901 ± 0.0496	590	298
Tarpon	0.1979 ± 0.0176	N/A	721	0
Bonefish	0.2365 ± 0.0315	N/A	228	0
Guide Anglers (Areas 1-6)				
Species	**CPUE ±95% Conf. Interval**	**HPUE ±95% Conf. Interval**	**Sample Size *** CPUE/HPUE	
Snook	0.4558 ± 0.0204	0.1119 ± 0.0043	2,508	556
Red Drum	0.4284 ± 0.0217	0.1290 ± 0.0035	2,424	1,076
Spotted Seatrout	1.5622 ± 0.0594	0.4585 ± 0.0174	2,591	1,068
Gray Snapper	1.4459 ± 0.1195	0.5212 ± 0.0397	791	413
Tarpon	0.1974 ± 0.0155	N/A	964	0
Bonefish	0.2365 ± 0.0314	N/A	228	0

Guide Anglers (Areas 6)				
Species	**CPUE ±95% Conf. Interval**	**HPUE ±95% Conf. Interval**	**Sample Size *** CPUE/HPUE	
Snook	0.6012 ± 0.0331	0.1192 ± 0.0055	1,330	297
Red Drum	0.4921 ± 0.0422	0.1401 ± 0.0050	907	521
Spotted Seatrout	1.4051 ± 0.0864	0.5281 ± 0.0262	801	504
Gray Snapper	0.8935 ± 0.1137	0.3389 ± 0.0484	200	114
Tarpon	0.1960 ± 0.0324	N/A	243	0
Bonefish	N/A	N/A	0	0

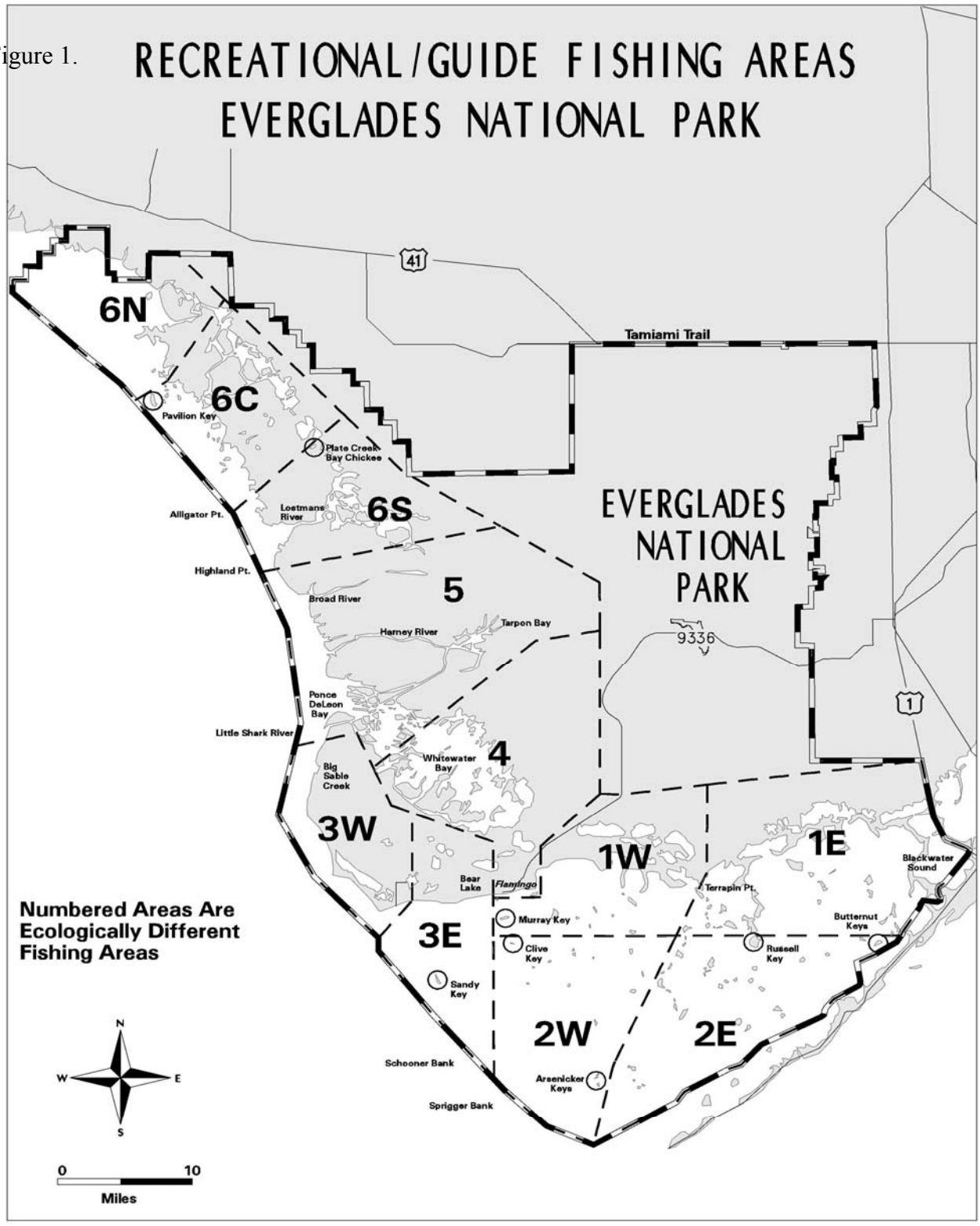
* Number of fishing parties.

Table 3. Total estimated catch and harvest by recreational non-guided (sport) and guided anglers from Everglades National Park, 2002.

Non-Guide Anglers						
Species	**Florida Bay**		**Everglades City**		**Florida Bay & Everglades City**	
	Catch	**Harvest**	**Catch**	**Harvest**	**Catch**	**Harvest**
Snook	18,841	1,864	23,923	1,250	42,764	3,114
Red Drum	31,328	7,614	10,046	2,887	41,374	10,501
Spotted Seatrout	136,278	24,640	34,253	9,539	170,531	34,179
Gray Snapper	95,108	20,039	28,850	2,418	123,958	22,457
Tarpon	2,103	0	724	0	2,827	0
Black Drum	8,307	4,205	436	95	8,743	4,300
Sheepshead	10,217	3,851	4,958	1,298	15,175	5,149
Spanish Mackerel	5,220	3,483	2,010	1,333	7,230	4,816
Grouper	7,754	404	2,364	127	10,118	531
Ladyfish	68,985	637	41,240	979	110,225	1,616
Crevalle Jack	78,044	1,915	35,677	11	113,721	1,926
Other species	122,847	9,095	47,444	5,508	170,291	14,603
Total	585,032	77,747	231,925	25,445	816,957	103,192

Guide Anglers						
Species	**Florida Bay**		**Everglades City**		**Florida Bay & Everglades City**	
	Catch	**Harvest**	**Catch**	**Harvest**	**Catch**	**Harvest**
Snook	10,064	917	22,736	1,092	32,800	2,008
Red Drum	16,274	2,477	11,639	2,420	27,959	4,902
Spotted Seatrout	76,894	8,226	26,742	8,686	103,730	16,912
Gray Snapper	19,276	5,128	4,106	1,164	23,395	6,323
Tarpon	3,756	0	1,202	0	4,959	0
Bonefish	1,025	0	0	0	1,025	0
Other Species	53,970	7,098	22,903	2,443	76,963	9,541
Total	181,257	23,845	89,329	15,805	270,831	39,686

Figure 1.


RECREATIONAL/GUIDE FISHING AREAS
EVERGLADES NATIONAL PARK
41
Tamiami Trail
6N
6C
6S
5
4
3W
3E
2W
2E
1W
1E
EVERGLADES NATIONAL PARK
9336
1
Pavilion Key
Plate Creek
Bay Chickee
Lostmans River
Alligator Pt.
Highland Pt.
Broad River
Harney River
Tarpon Bay
Ponce DeLeon Bay
Little Shark River
Whitewater Bay
Big Sable Creek
Bear Lake
Flamingo
Terrapin Pt.
Blackwater Sound
Murray Key
Clive Key
Butternut Keys
Russell Key
Sandy Key
Schooner Bank
Arsenicker Keys
Sprigger Bank
Numbered Areas Are Ecologically Different Fishing Areas
N
W
E
S
0
10
Miles

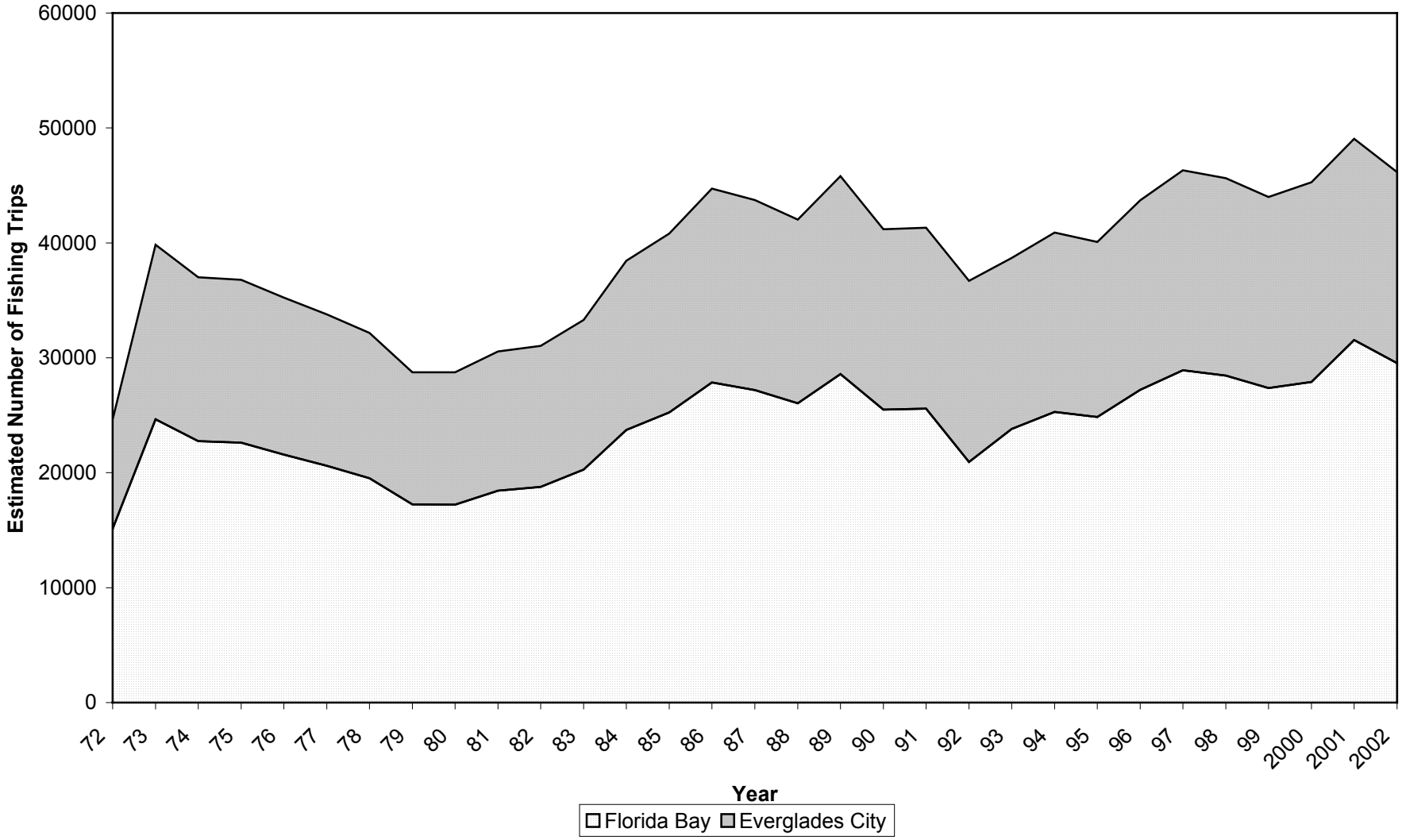


Figure 2. Estimated number of non-guided fishing trips within Everglades National Park, 1972-2002.

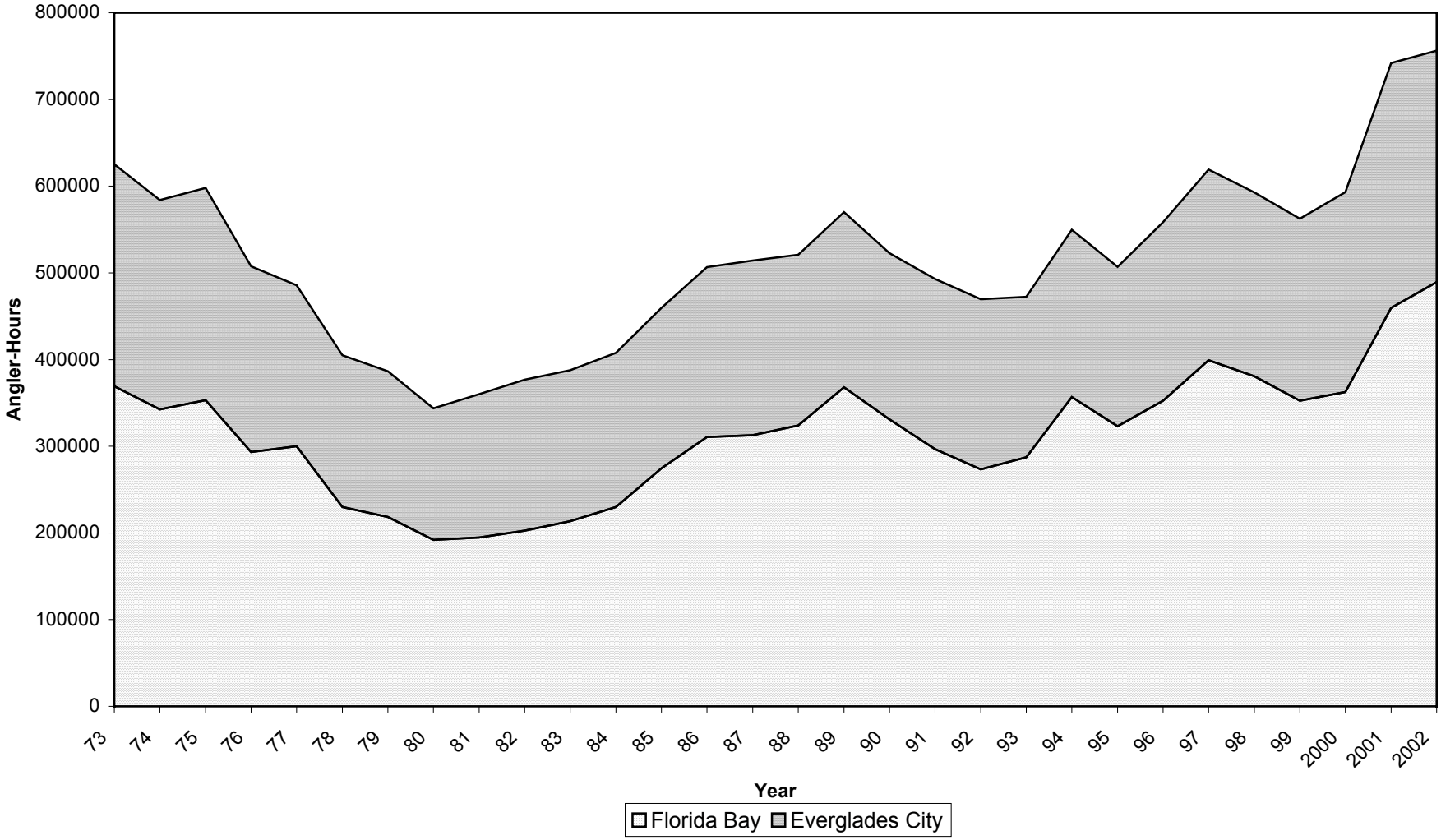


Figure 3. Estimated total effort (angler-hours) of non-guided fishermen within Everglades National Park, 1973-2002.

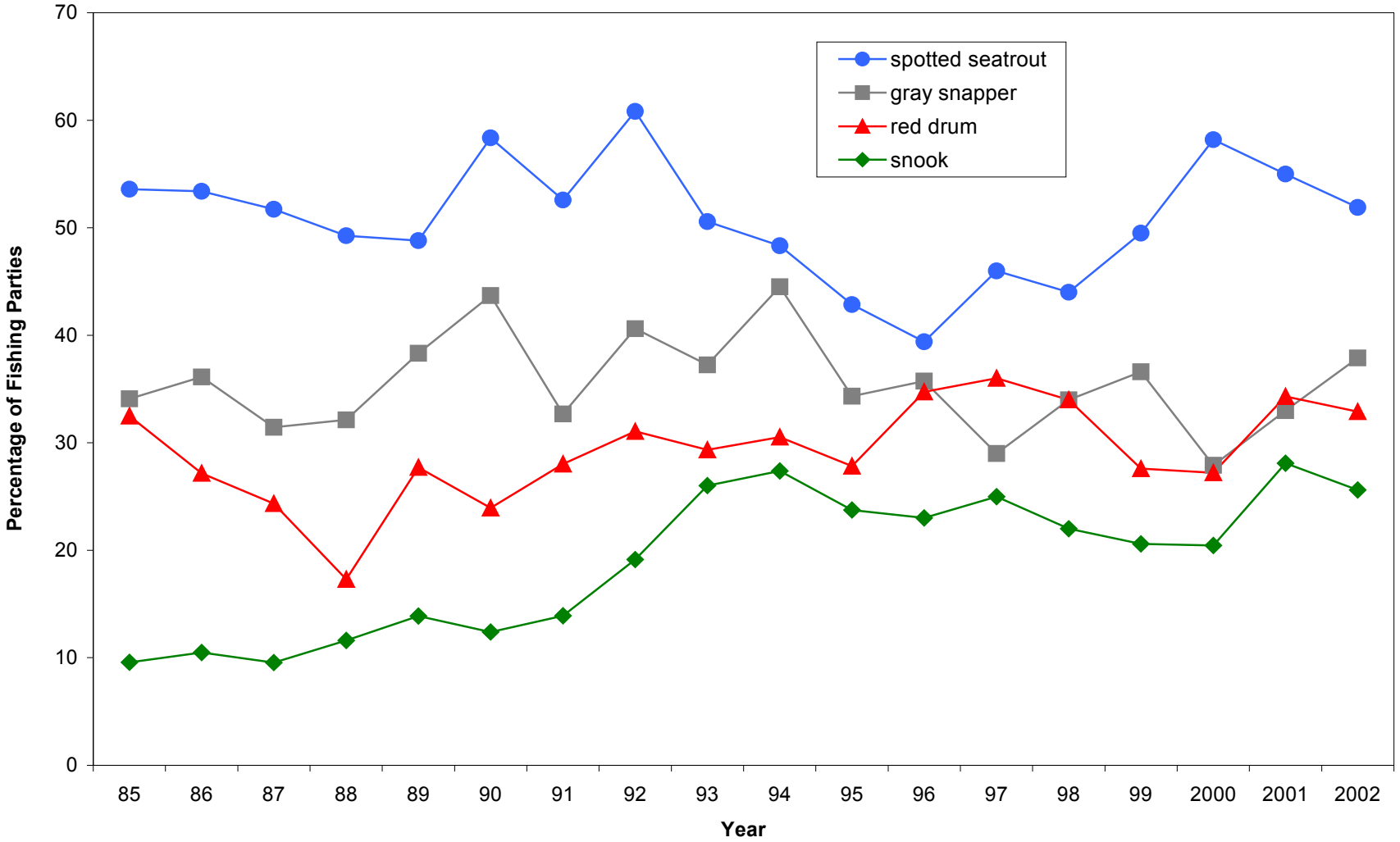


Figure 4. Percentage of fishing parties interviewed at Flamingo (Areas 1 to 5) catching spotted seatrout, gray snapper, red drum, and snook from 1985-2002.

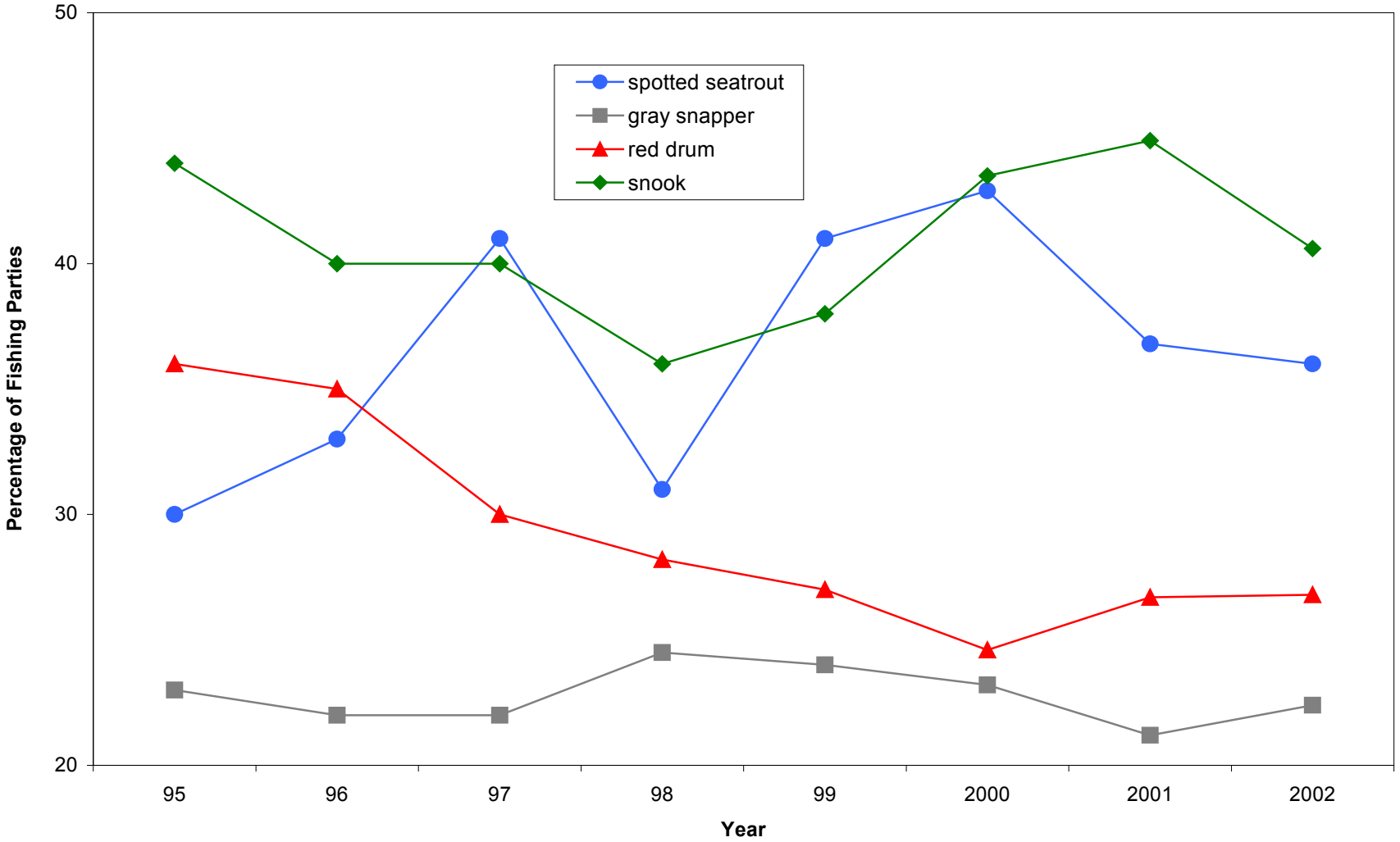
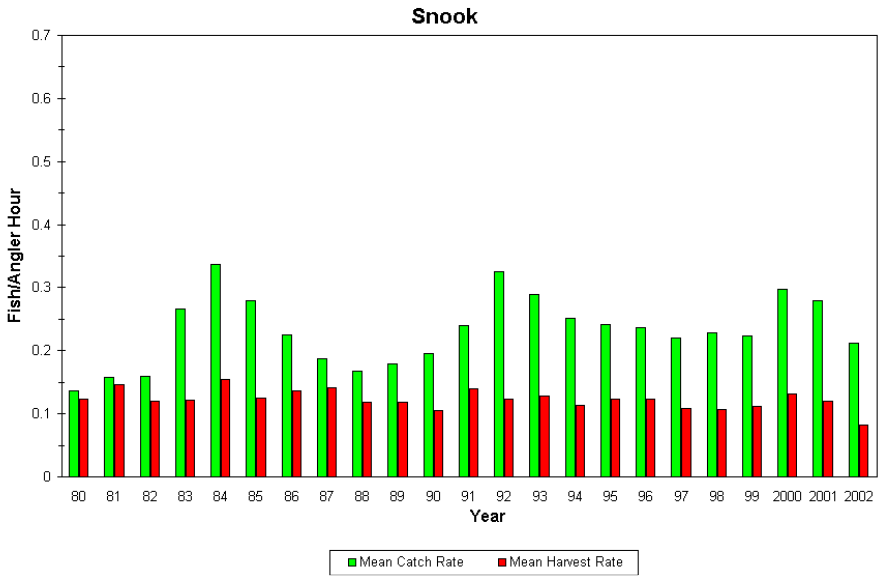
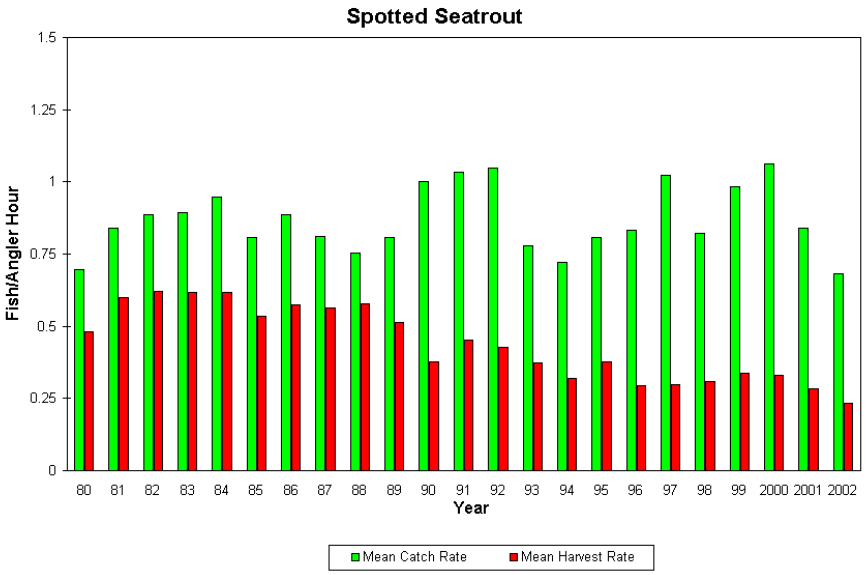
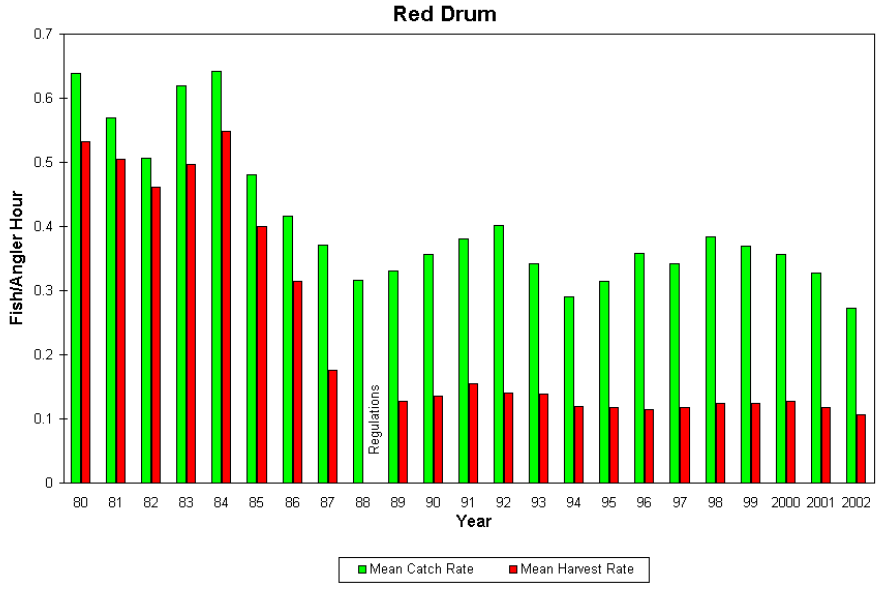


Figure 4a. Percentage of fishing parties interviewed at Everglades City (Area 6) catching spotted seatrout, gray snapper, red drum, and snook from 1995-2002.







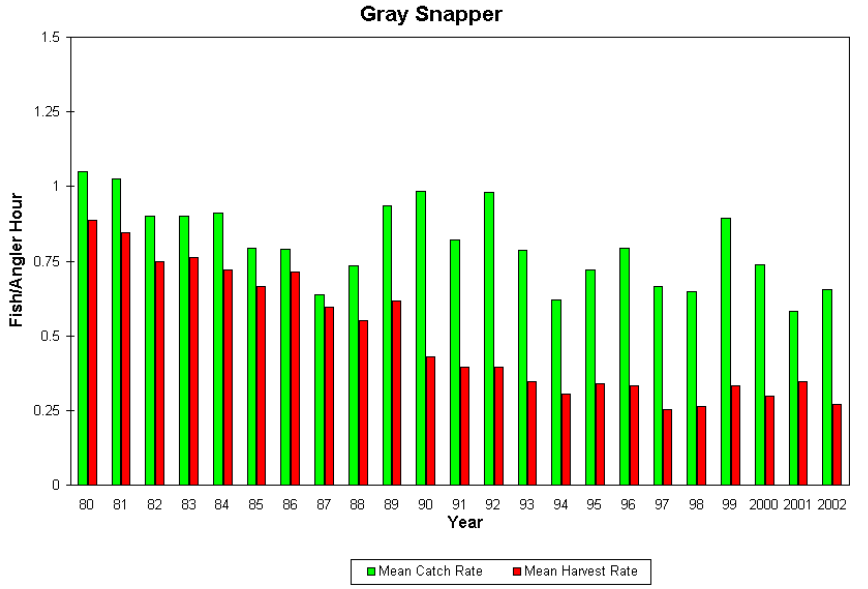


Figure 5. Recreational non-guided (sport) catch and harvest rates for the four major species of gamefish in Florida Bay, Everglades National Park (Areas 1-5), 1980-2002.

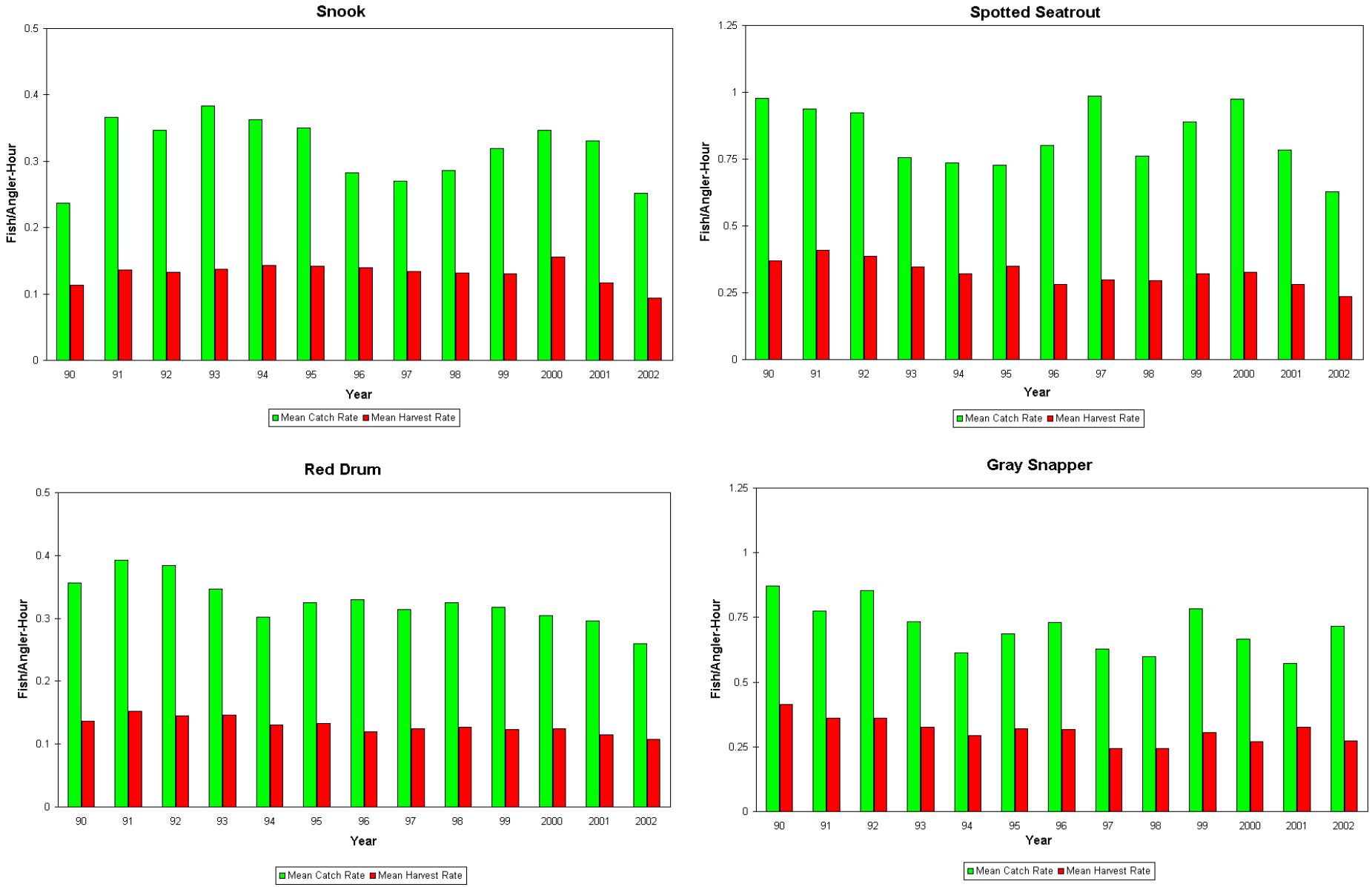
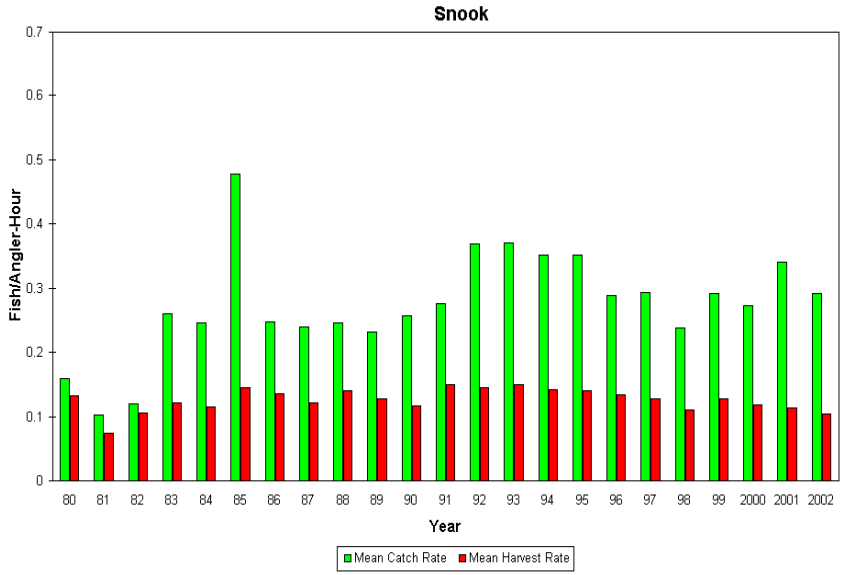
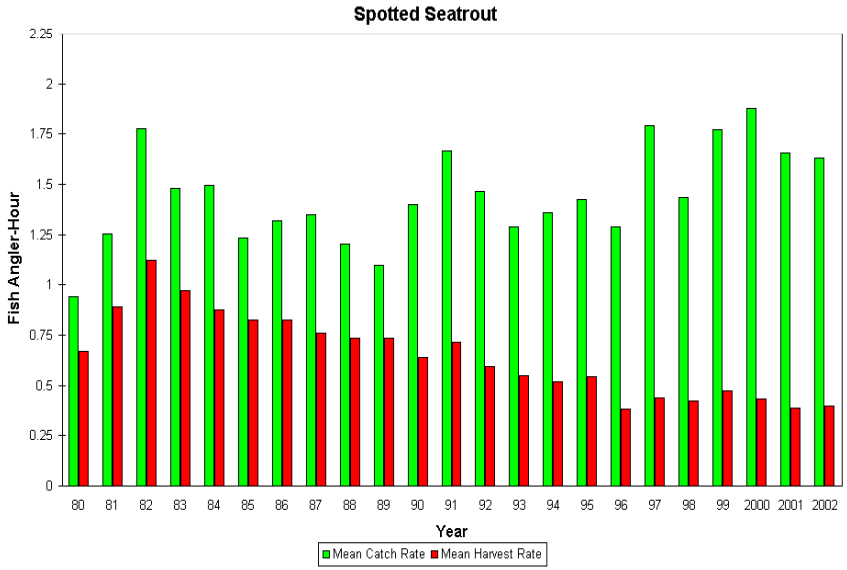
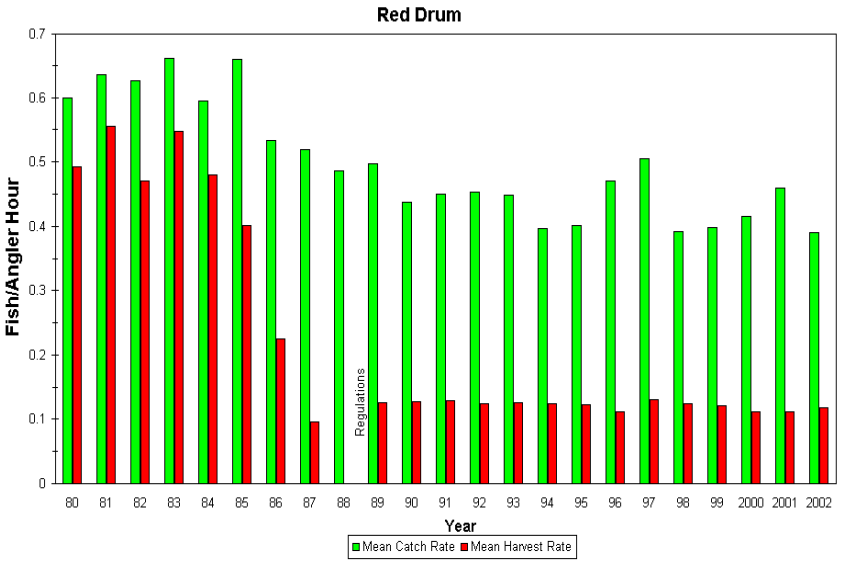


Figure 6. Recreational non-guided (sport) catch and harvest rates for the four major species of gamefish in Everglades National Park (Areas 1-6), 1990-2002.







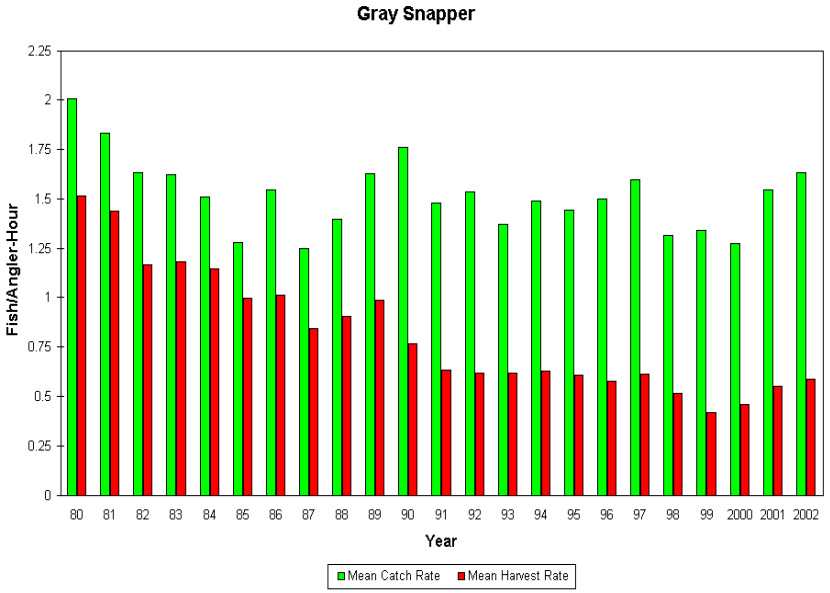


Figure 7. Recreational guide catch/harvest rates for the four major gamefish species in Florida Bay (Areas 1-5), 1980-2002.

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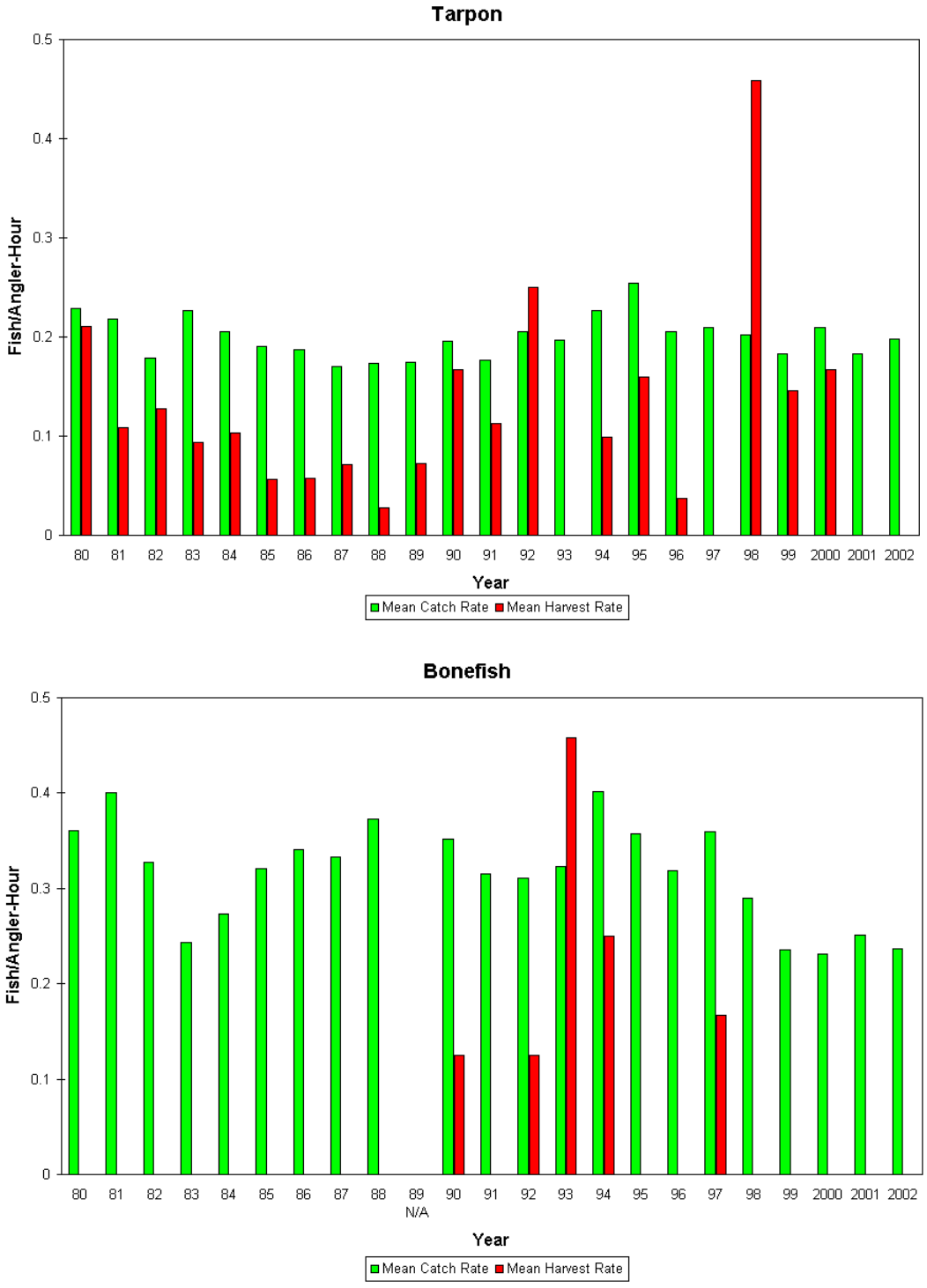


Figure 8. Recreational guide catch and harvest rates for tarpon and bonefish in Florida Bay (Areas 1-5) 1980-2002.

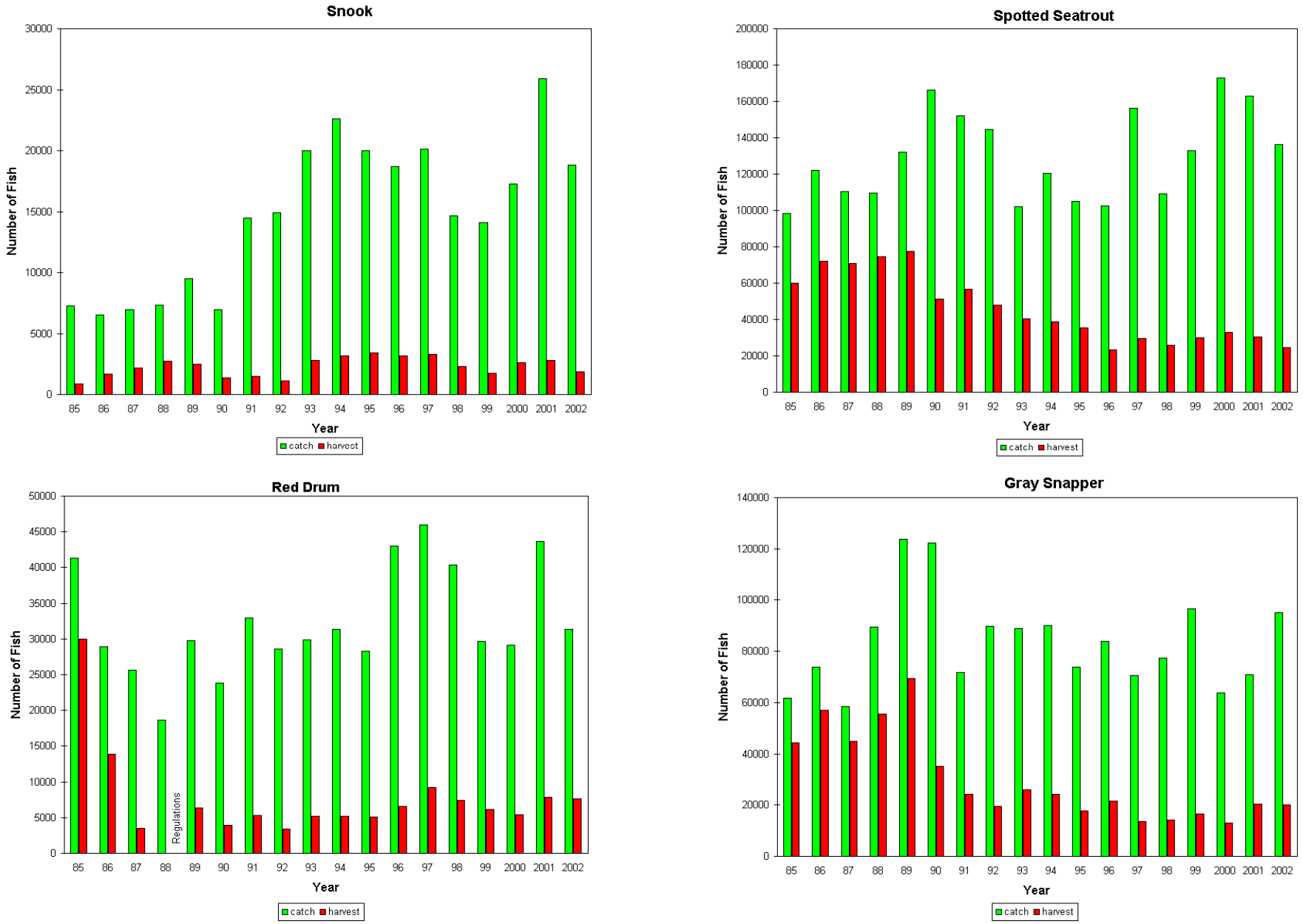


Figure 9. Estimated total catch and harvest for the four major species of gamefish by non-guided (sport) anglers in Florida Bay (Areas 1-5), 1985-2002.

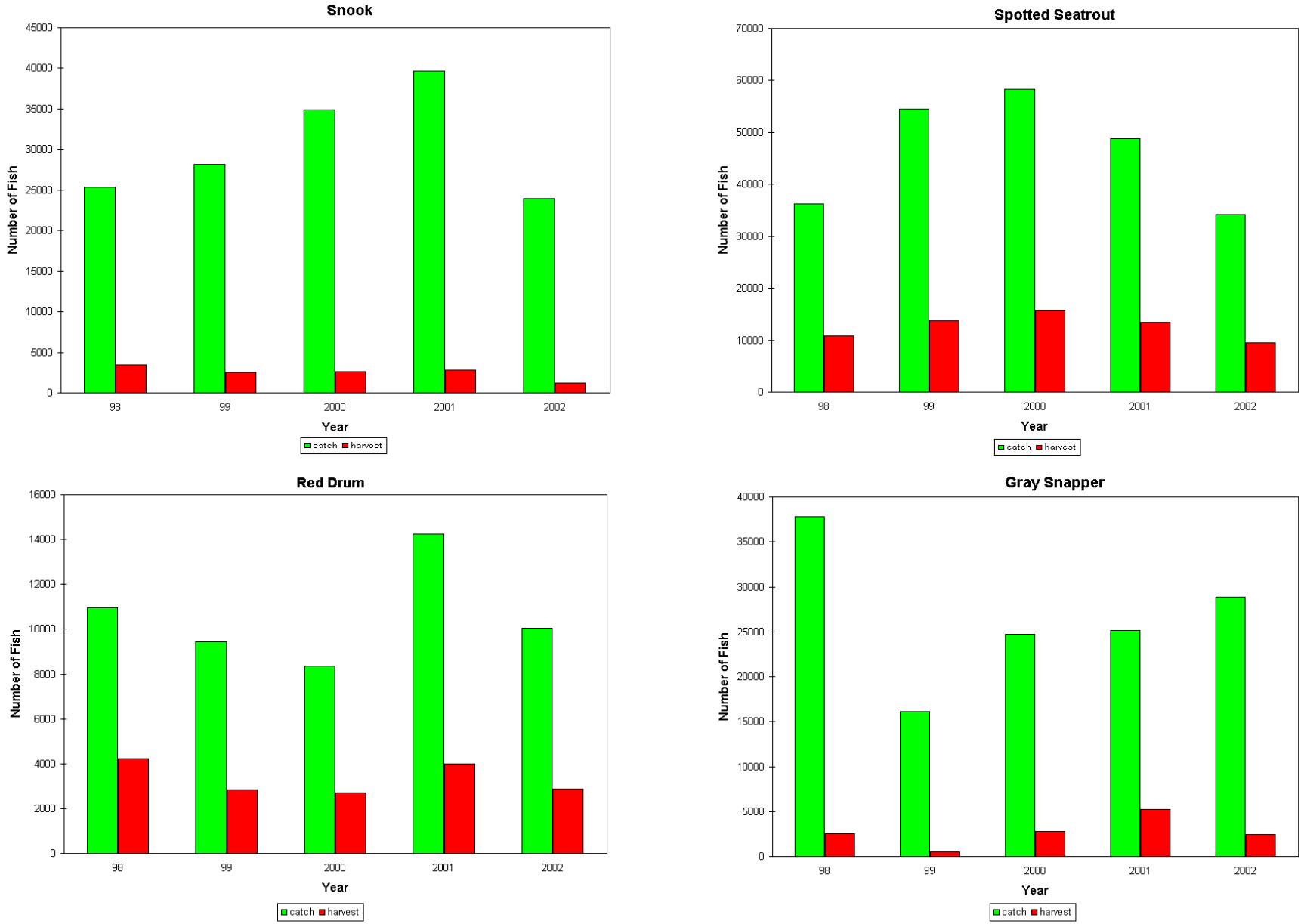


Figure 9a. Estimated total catch and harvest for the four major species of gamefish by non-guided (sport) anglers in Everglades City (Area 6), 1998-2002.

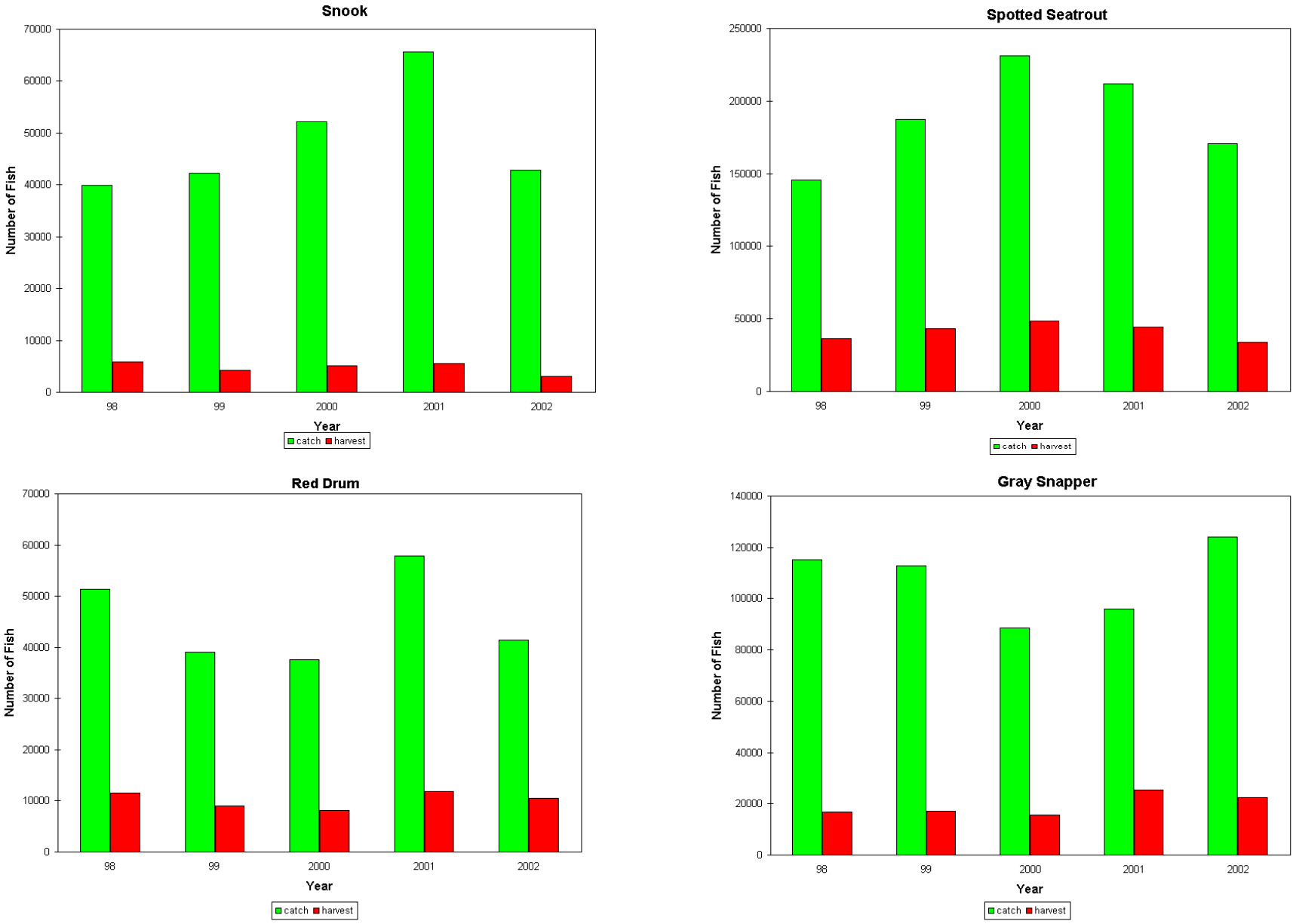


Figure 9b. Estimated total catch and harvest for the four major species of gamefish by non-guided (sport) anglers in Florida Bay and Everglades City (Areas 1-6), 1998-2002.

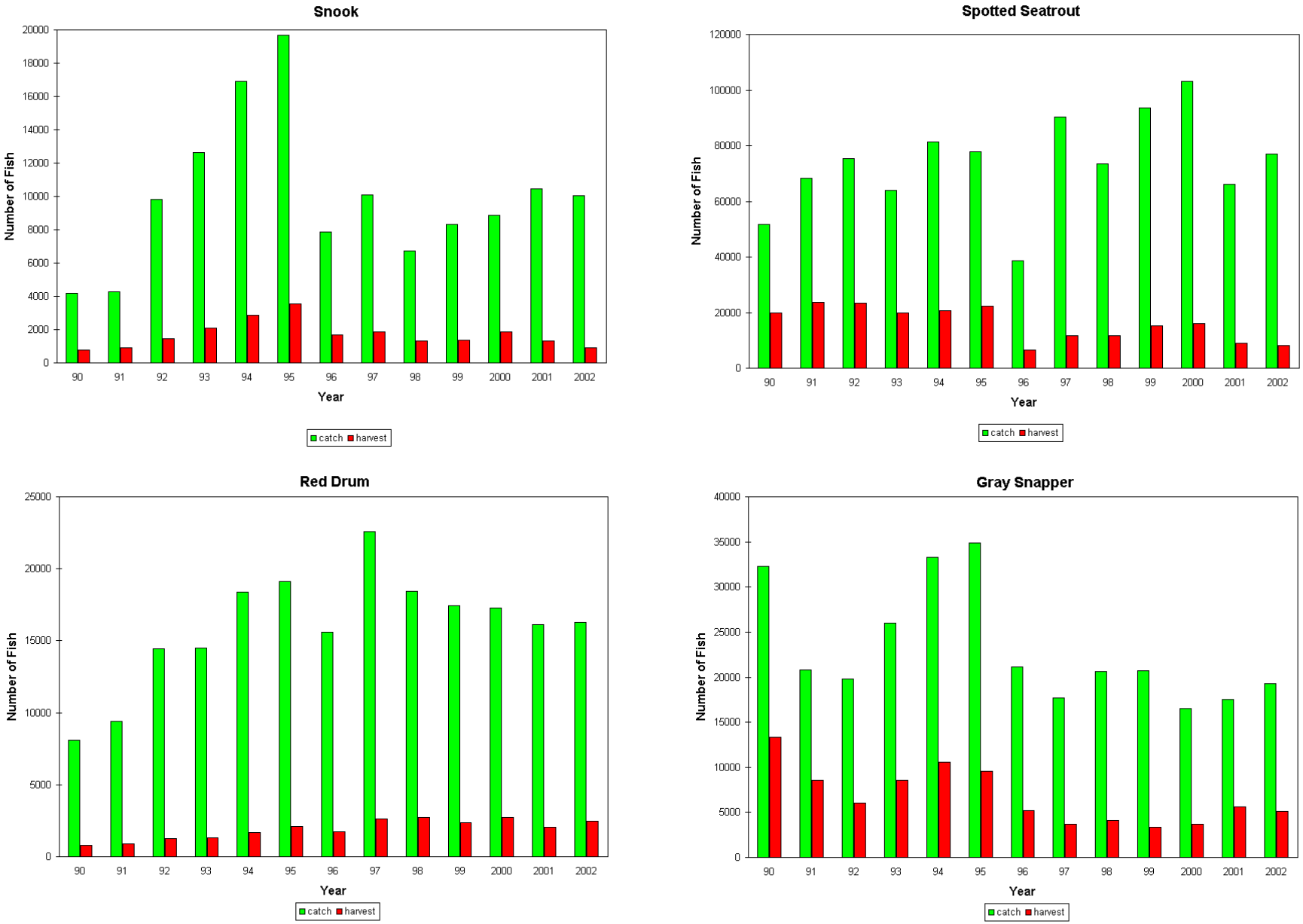
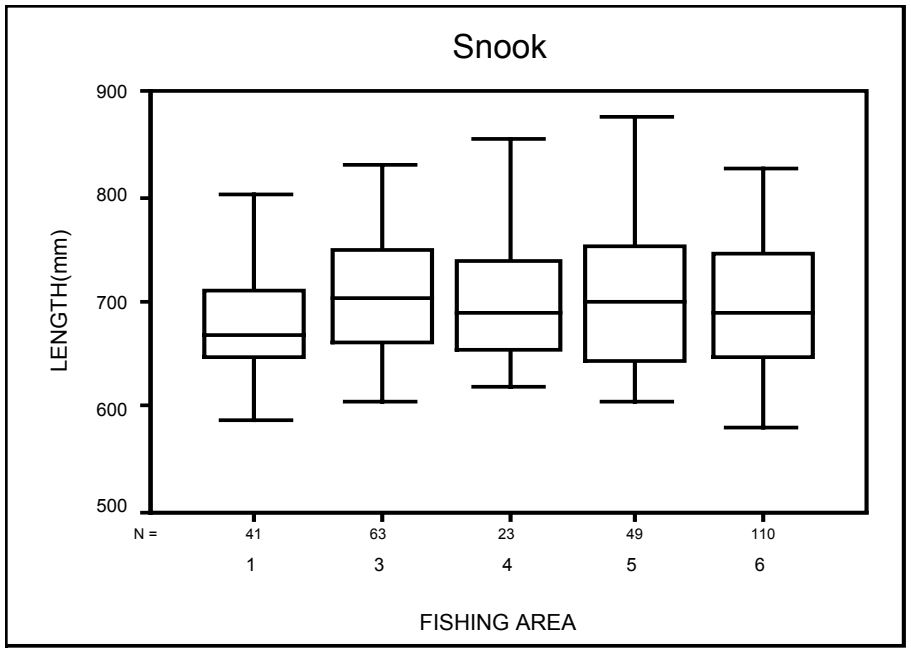
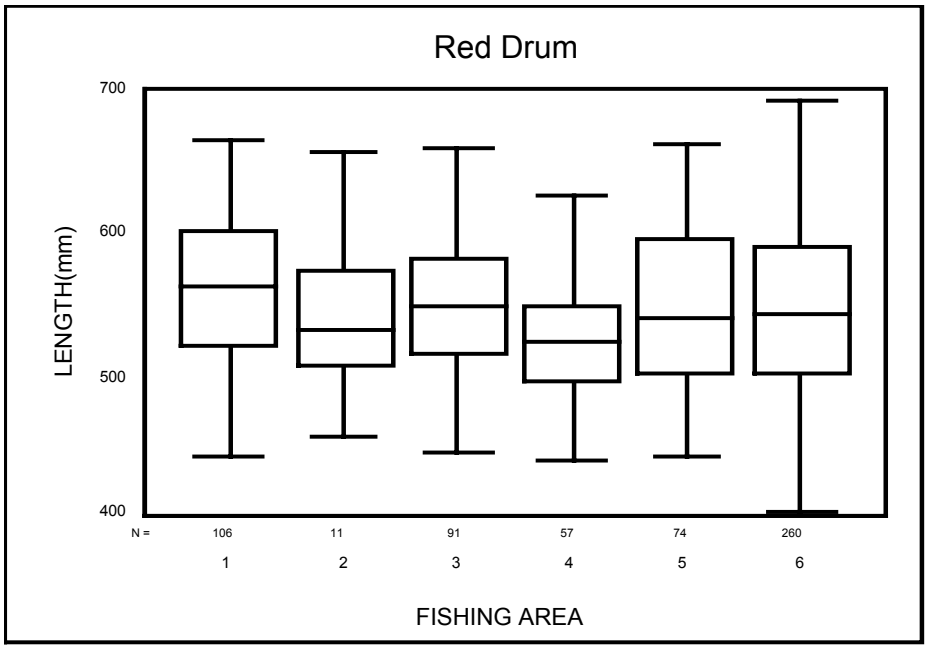
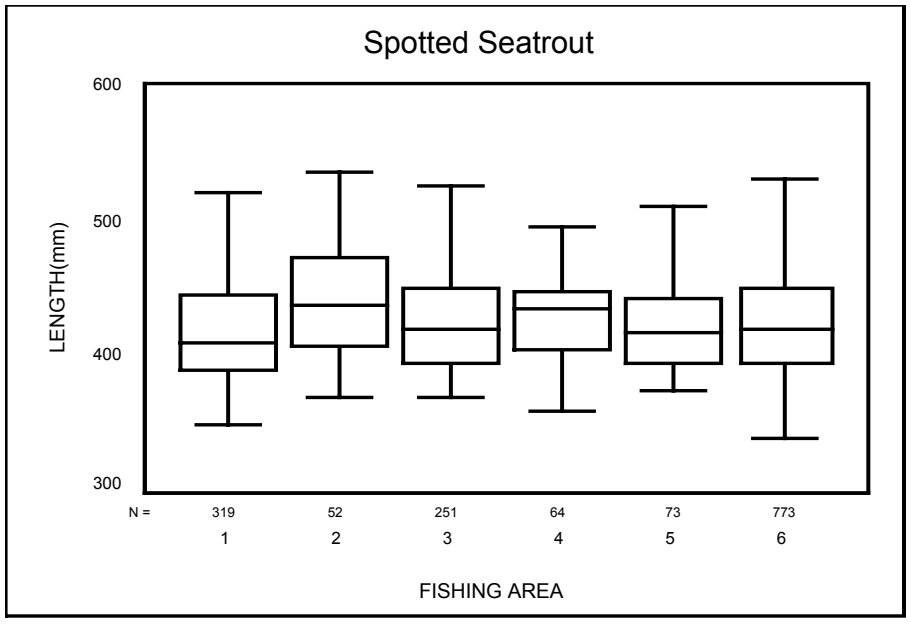


Figure 10. Estimated total catch and harvest of the four major species of gamefish by guided anglers in Florida Bay (Areas 1-5), 1990-2002.







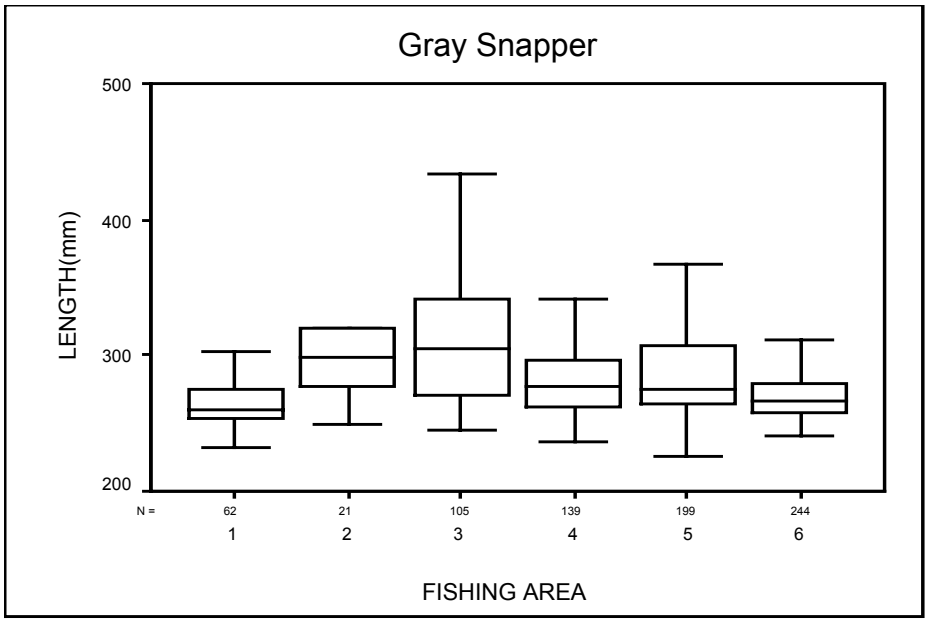
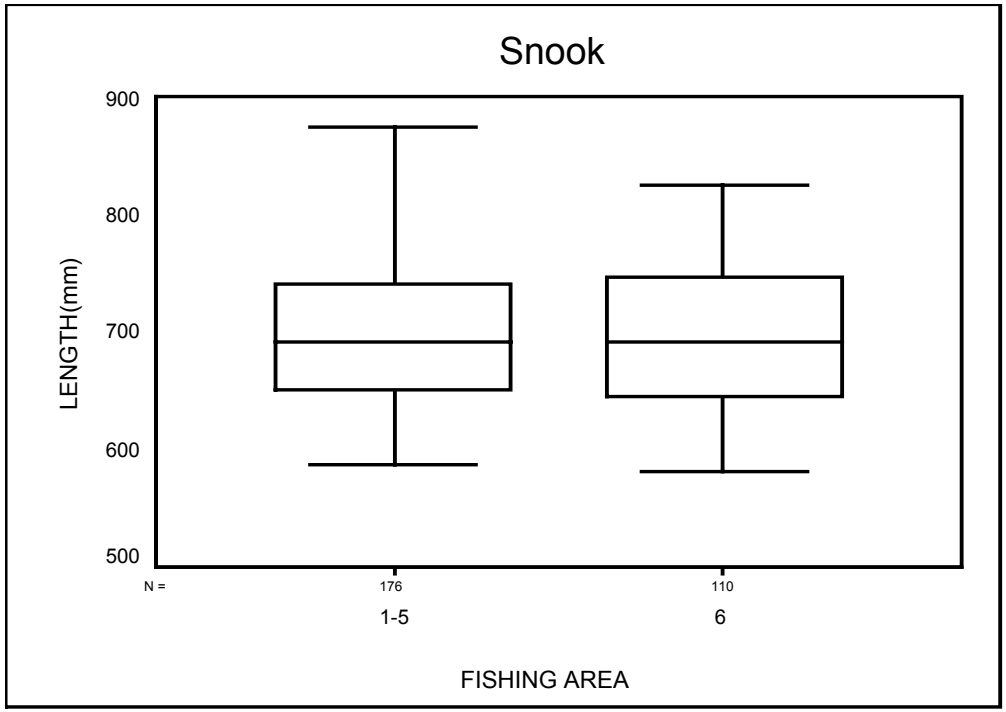
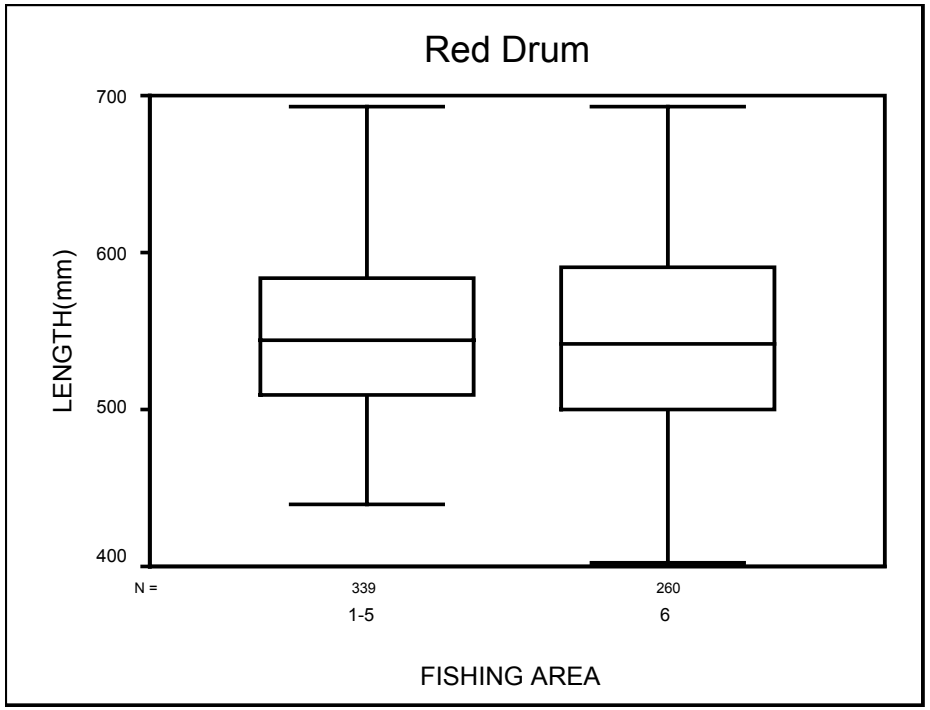
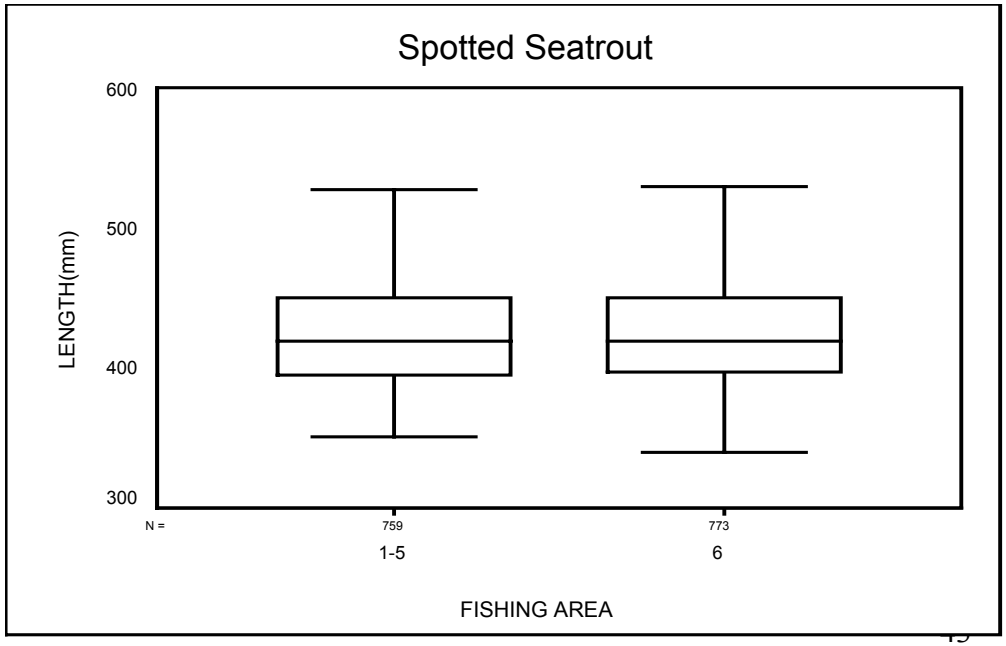


Figure 11. The lengths of the four major species of fish caught by recreational (non-guided) anglers in the six ecologically distinct fishing areas within Everglades National Park during 2002. The "box" represents the interquartile range; the horizontal line in the "box" represents the median; N represents the number of fish measured in each area.







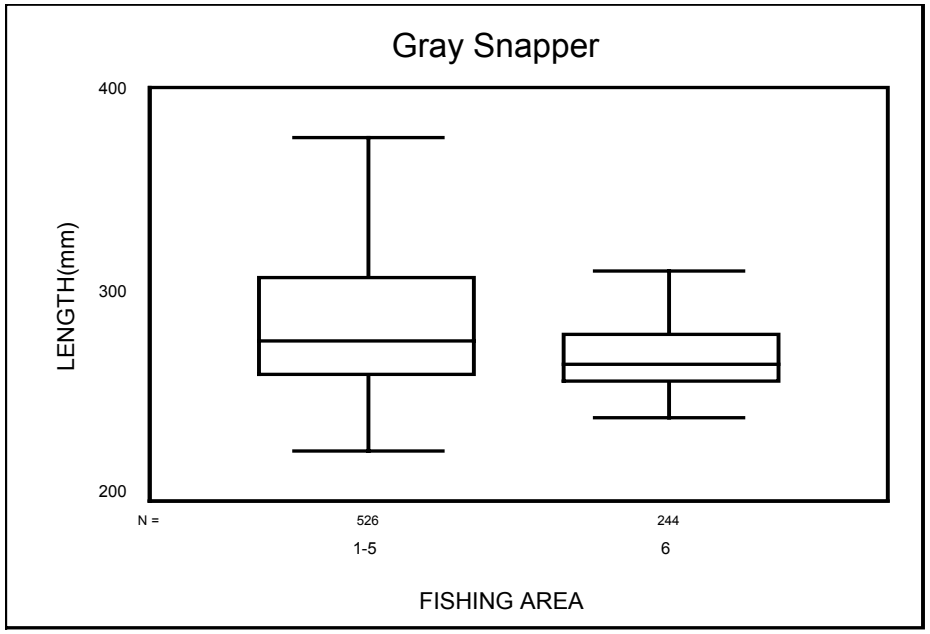


Figure 12. The lengths of the four major species of fish caught by recreational (non-guided) anglers in Florida Bay (Areas 1-5) and Everglades City (Area 6) within Everglades National Park during 2002. The "box" represents the interquartile range; the horizontal line in the "box" represents the median; N represents the number of fish measured in each area.

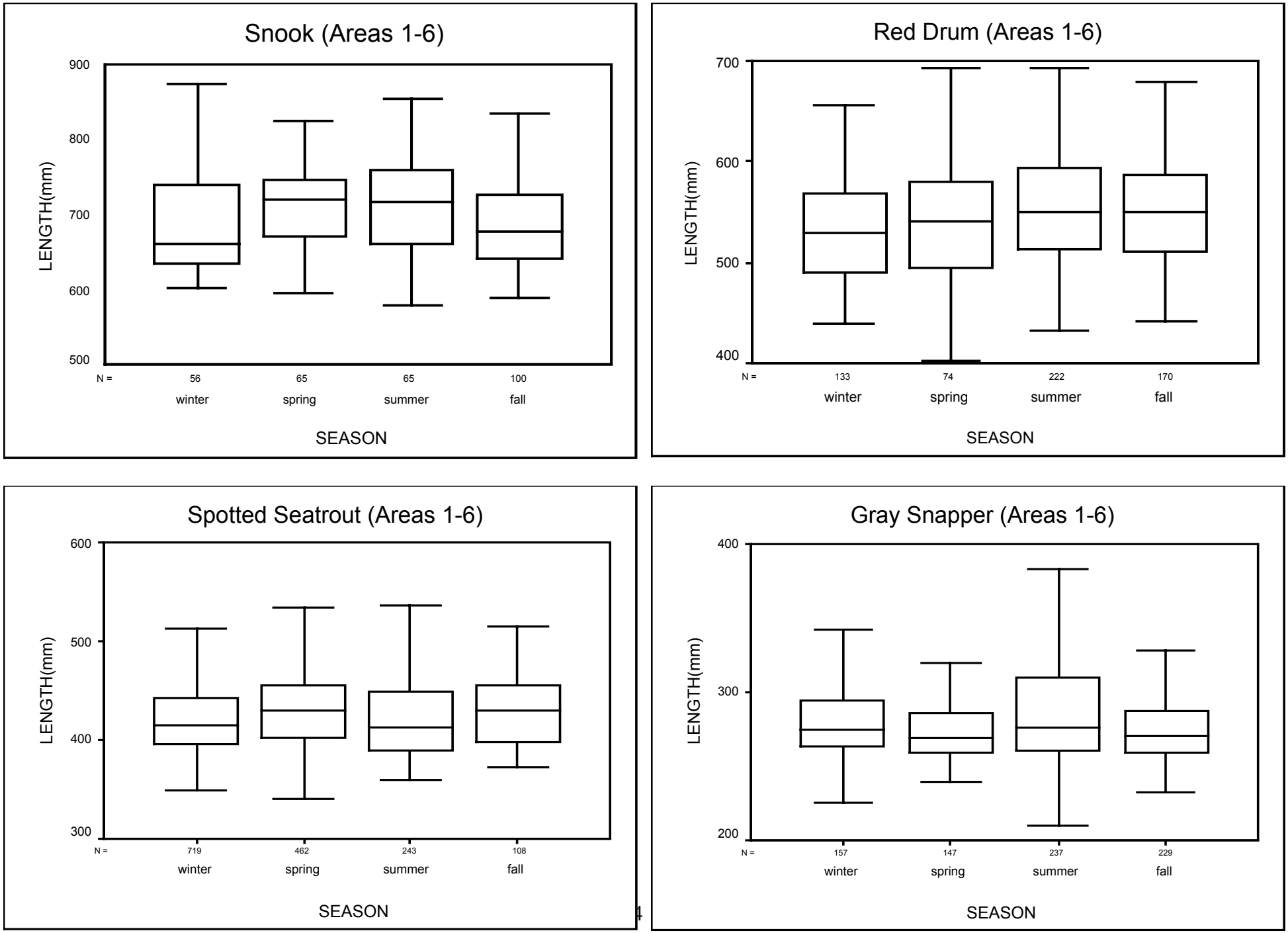
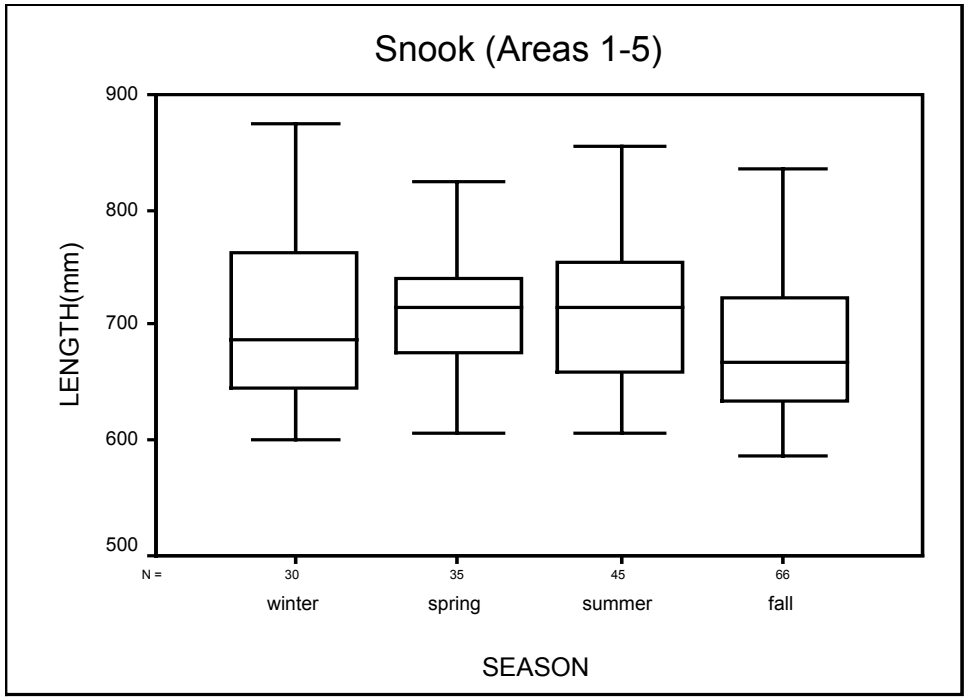
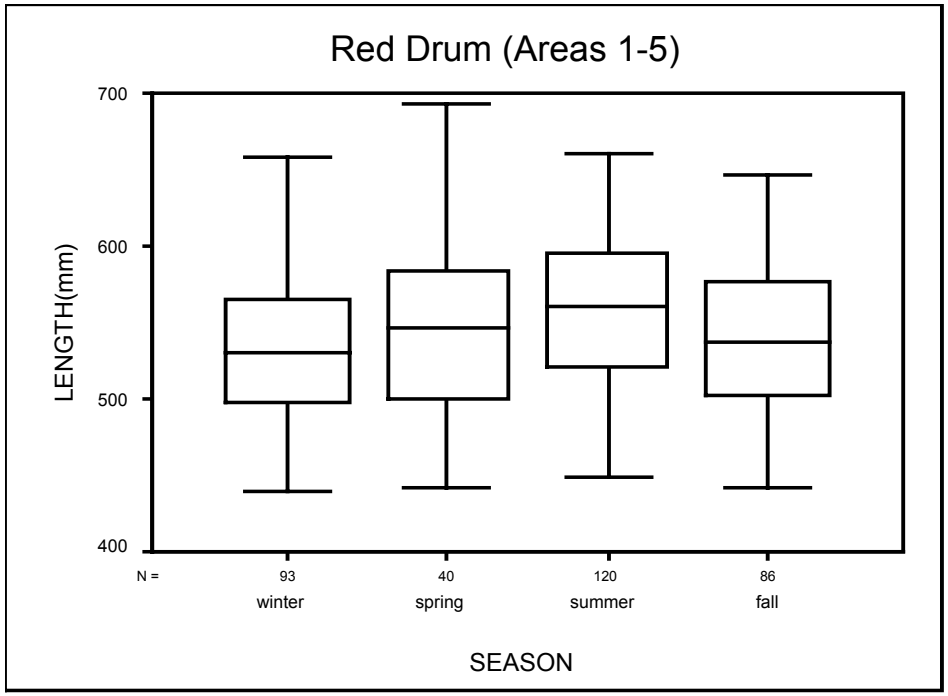
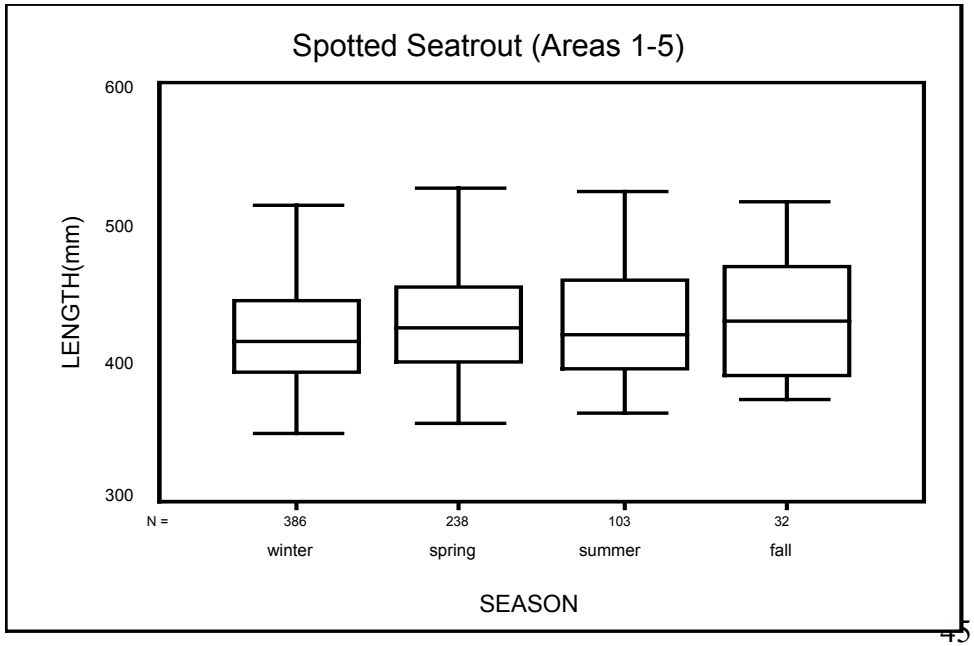


Figure 13. The lengths of the four major species of fish caught by recreational (non-guided) anglers in Everglades National Park during the fall, spring, summer, and winter of 2002. The "box" represents the interquartile range; the horizontal line in the "box" represents the median; N represents the number of fish measured in each area.







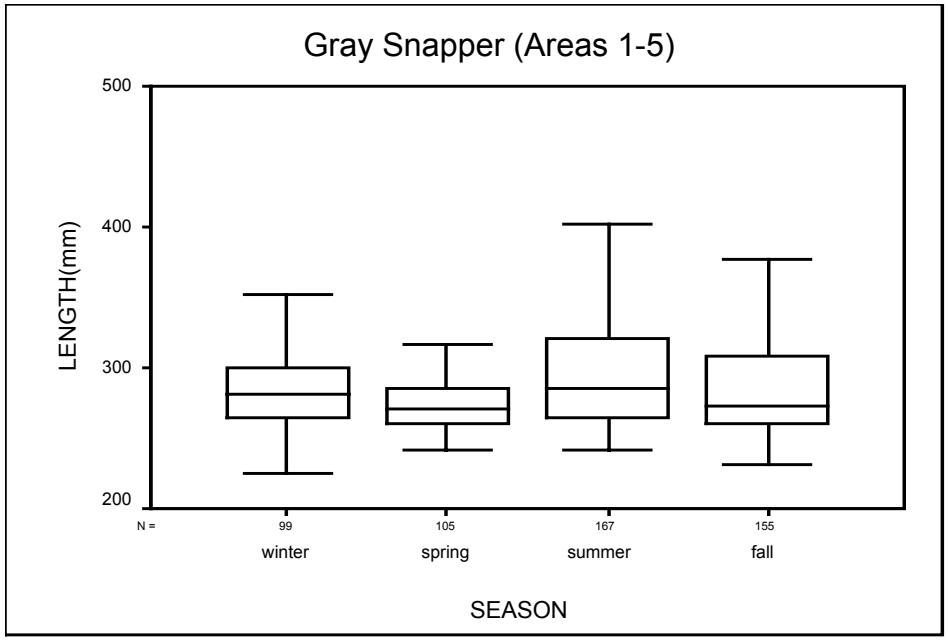
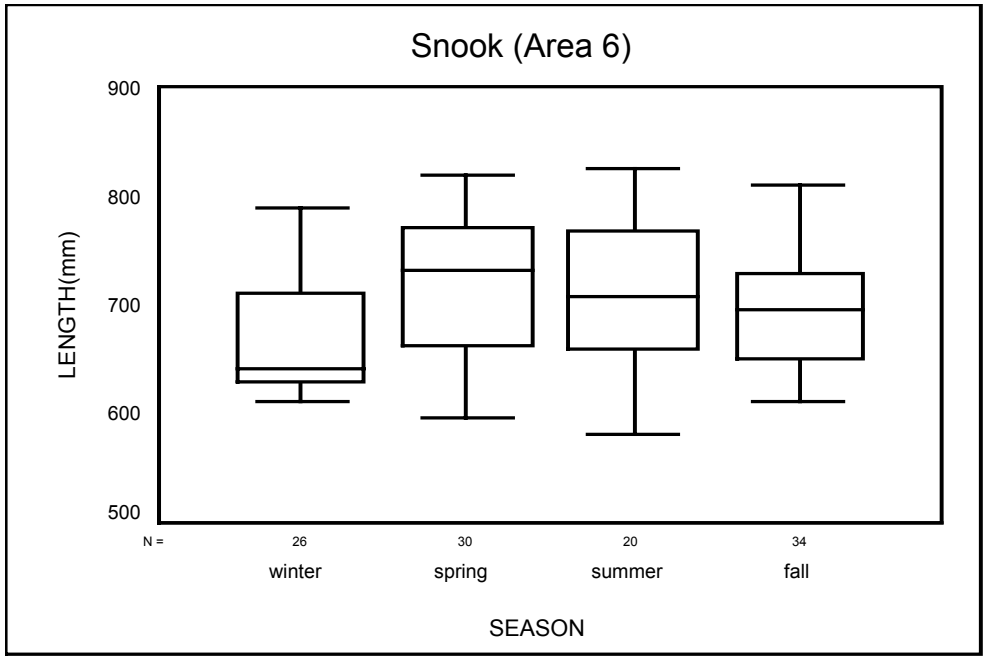
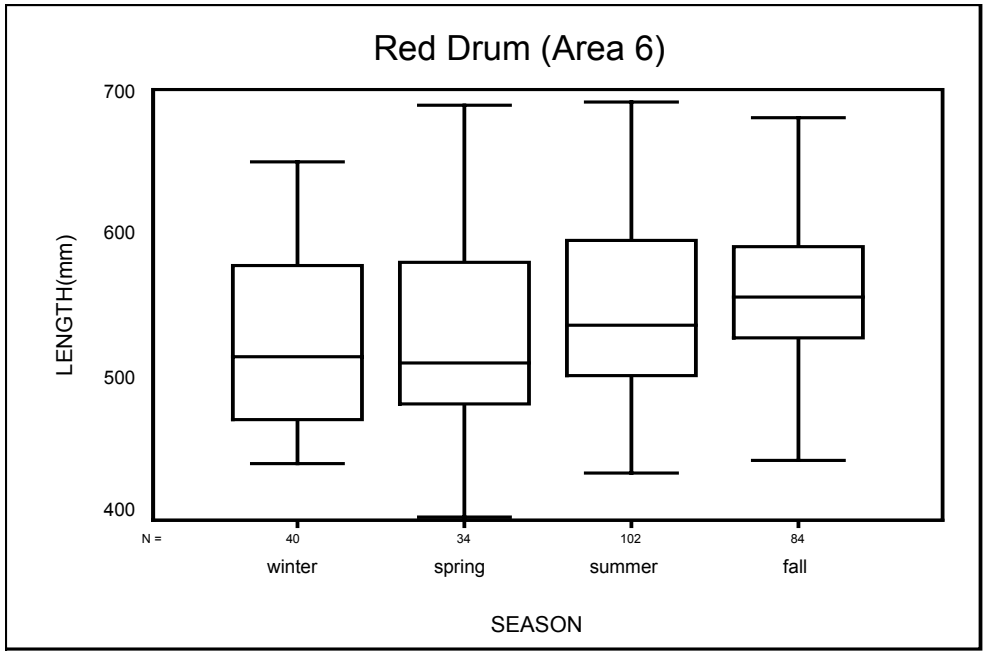
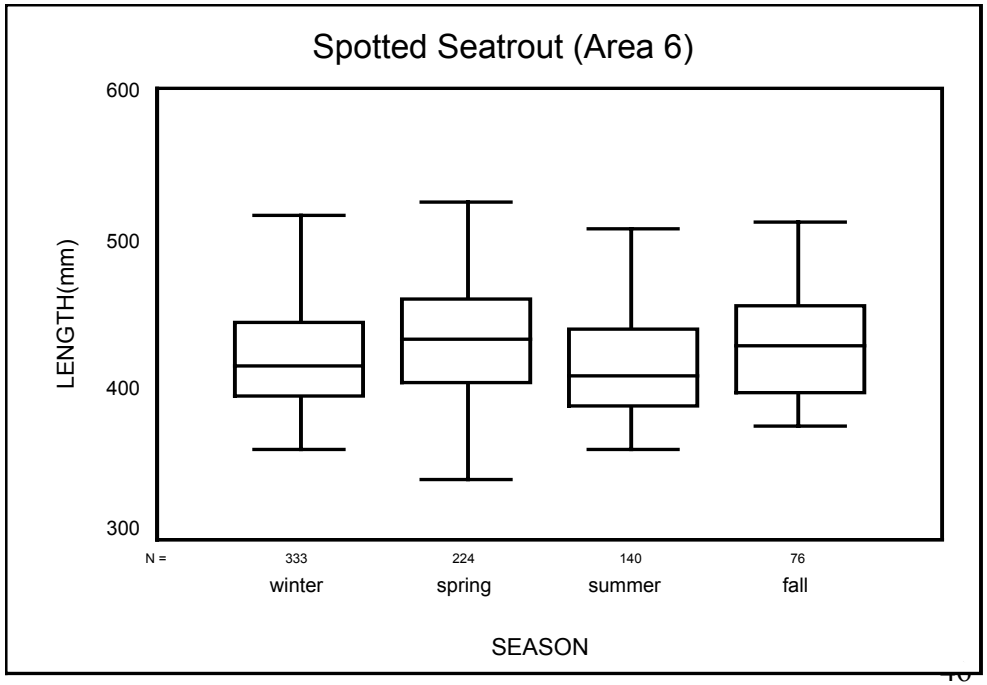


Figure 14. The lengths of the four major species of fish caught by recreational (non-guided) anglers in Florida Bay (Areas 1-5) during the fall, spring, summer, and winter of 2002. The "box" represents the interquartile range; the horizontal line in the "box" represents the median; N represents the number of fish measured in each area.







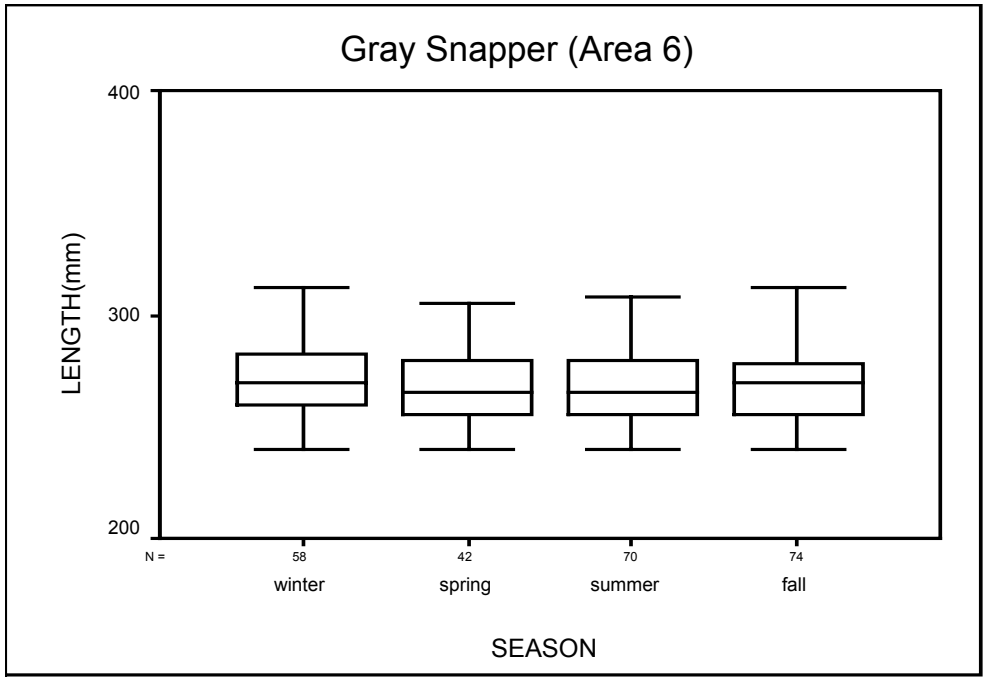


Figure 15. The lengths of the four major species of fish caught by recreational (non-guided) anglers in Everglades City (Area 6) during the fall, spring, summer, and winter of 2002. The "box" represents the interquartile range; the horizontal line in the "box" represents the median; N represents the number of fish measured in each area.

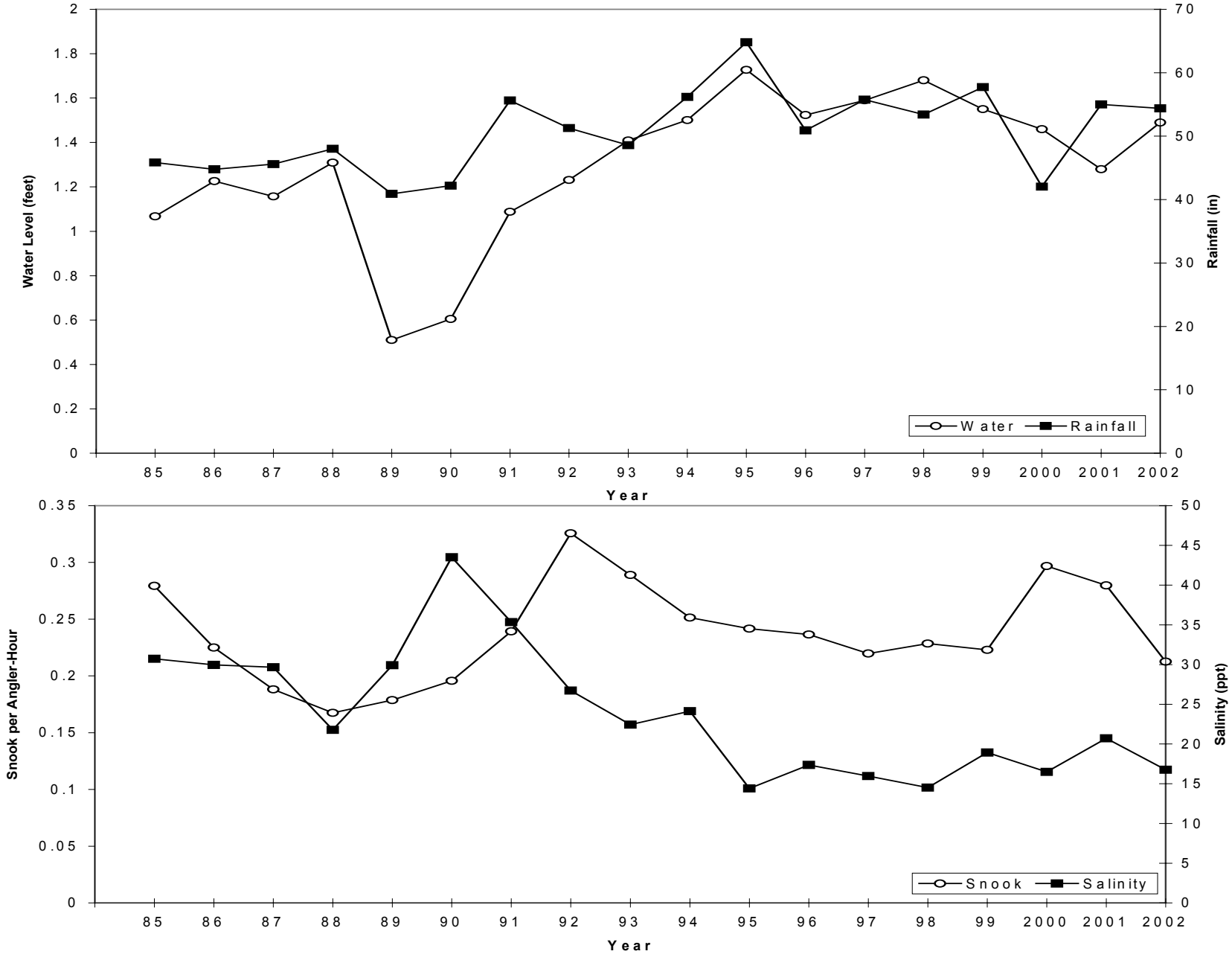


Figure 16. Average rainfall recorded at 5 stations in or near ENP, average water level at P-37 in Taylor Slough, average salinity at 2 stations in northern Florida Bay, and non-guide catch rates of Snook in Florida Bay (Areas 1-5) from 1985 to 2002.

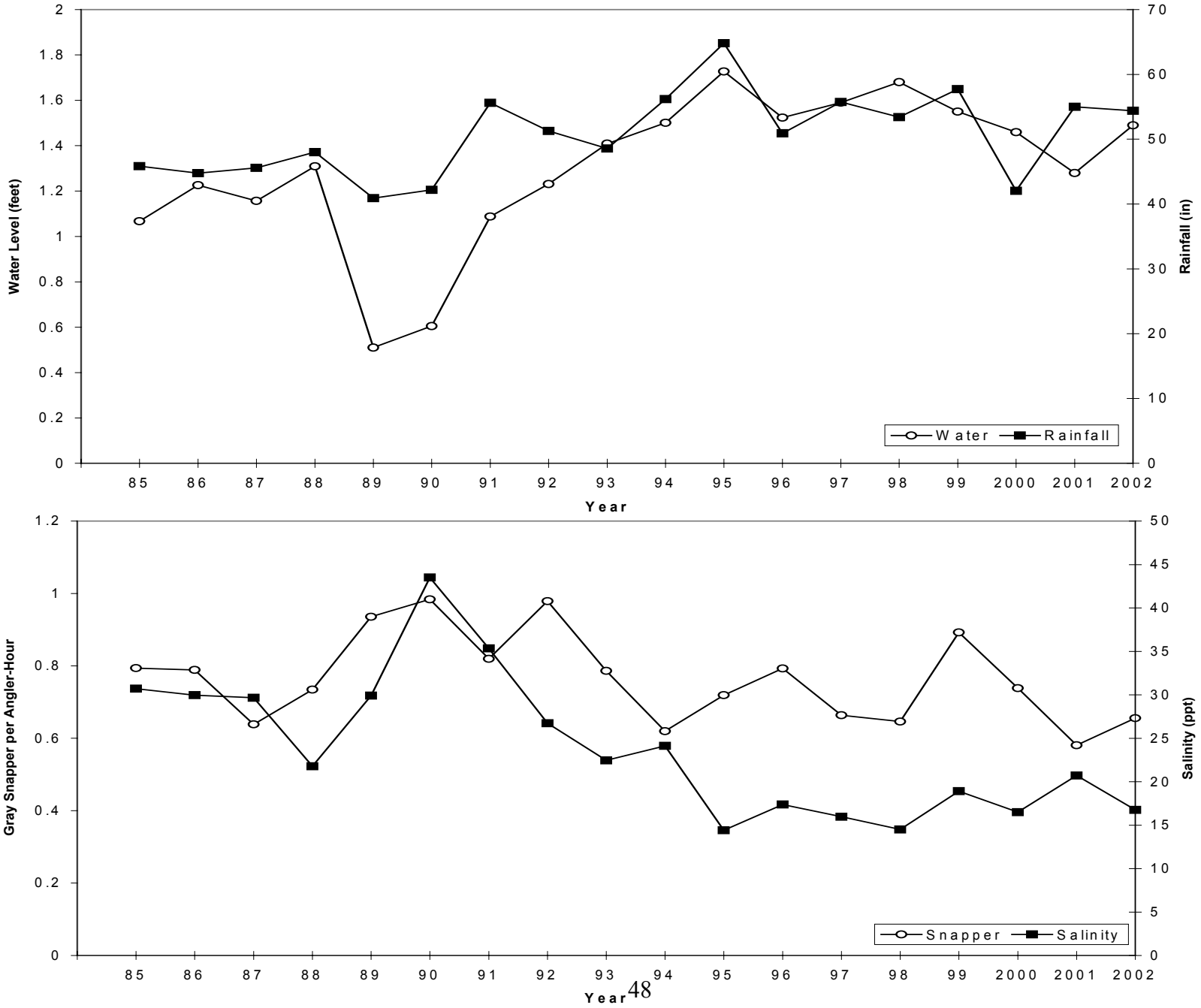


Figure 17. Average rainfall recorded at 5 stations in or near ENP, average water level at P-37 in Taylor Slough, average salinity at 2 stations in northern Florida Bay, and non-guide catch rates of Snapper in Florida Bay (Areas 1-5) from 1985 to 2002.

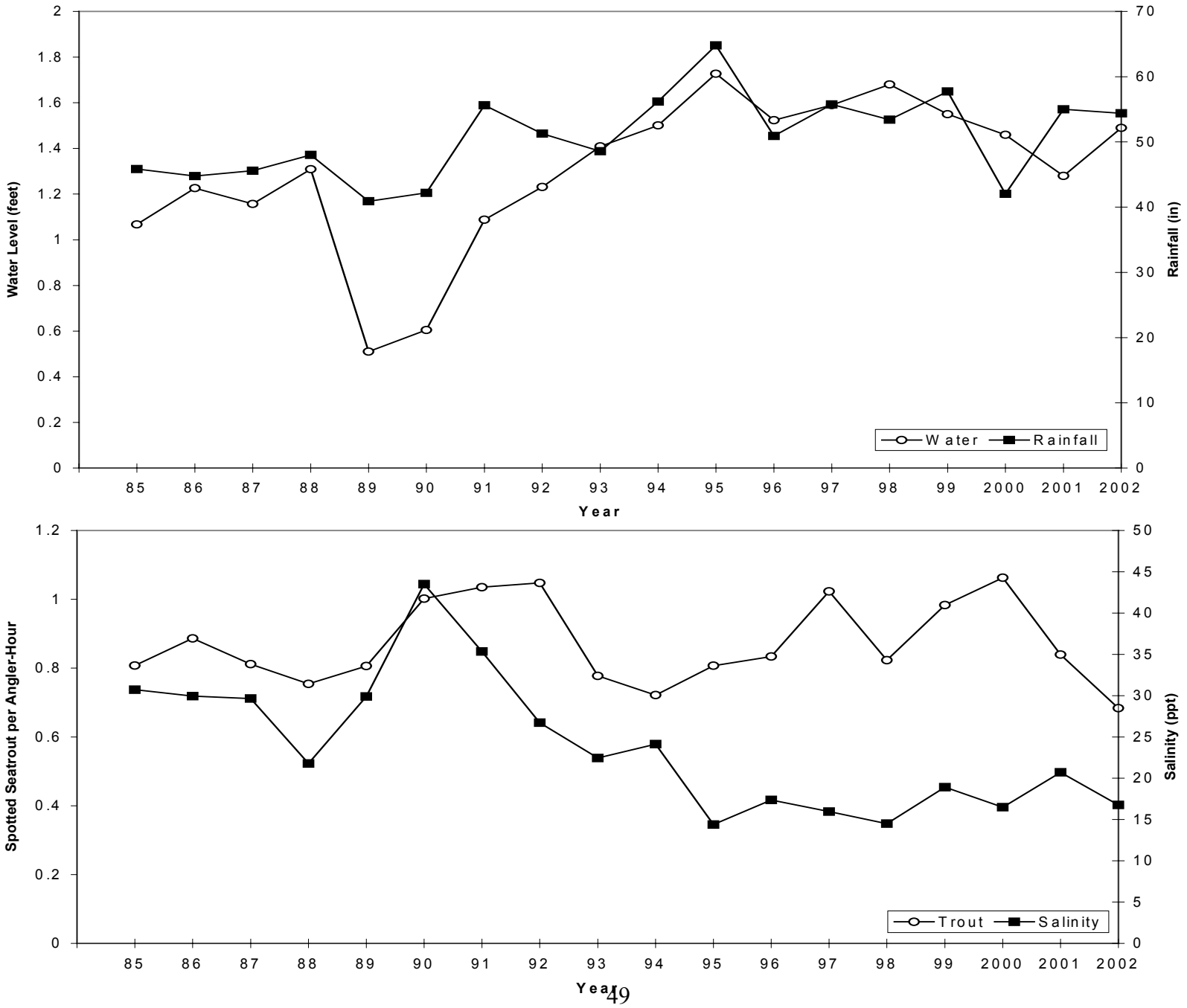


Figure 18. Average rainfall recorded at 5 stations in or near ENP, average water level at P-37 in Taylor Slough, average salinity at 2 stations in northern Florida Bay, and non-guide catch rates of Trout in Florida Bay (Areas 1-5) from 1985 to 2002.

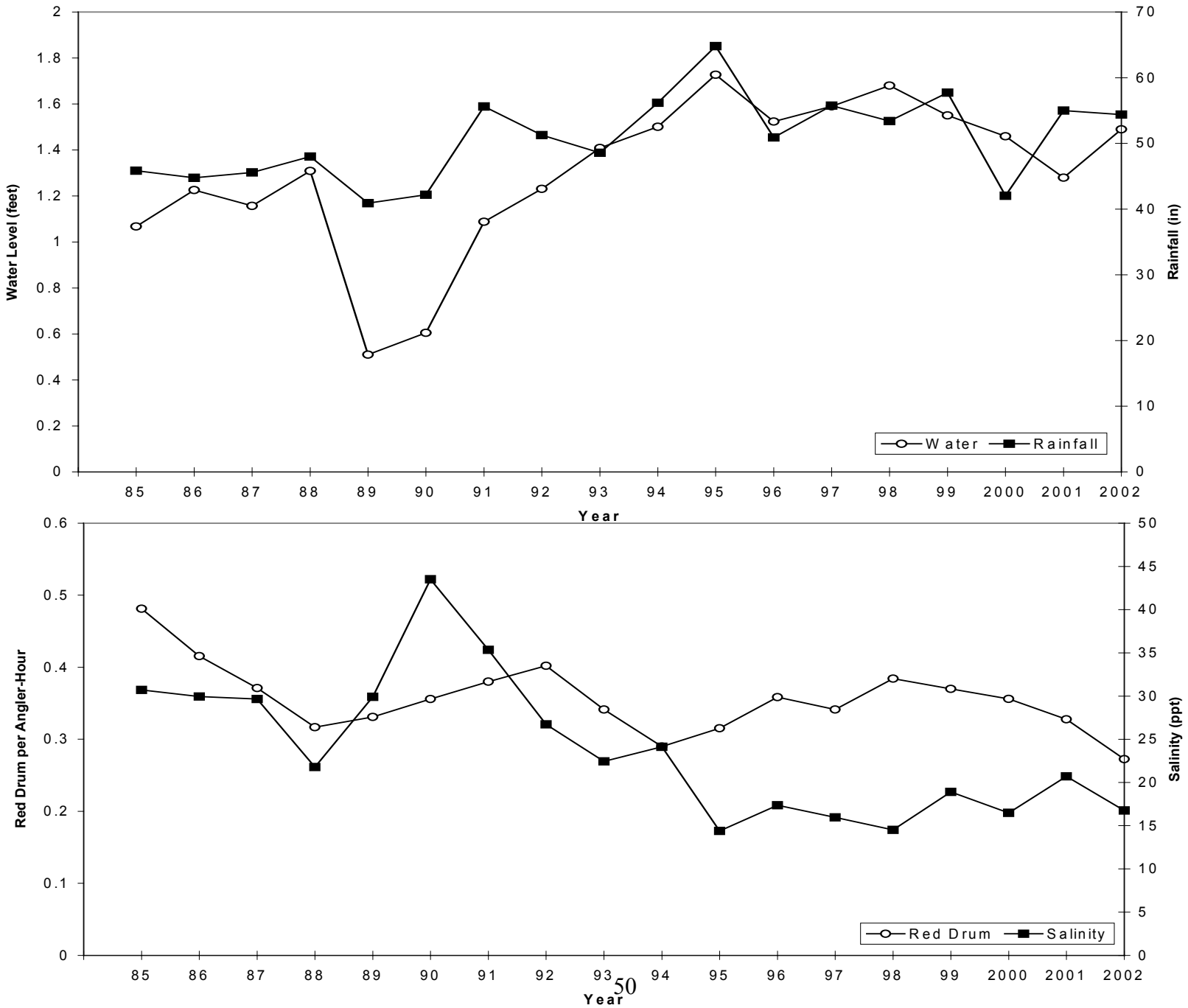


Figure 19. Average rainfall recorded at 5 stations in or near ENP, average water level at P-37 in Taylor Slough, average salinity at 2 stations in northern Florida Bay, and non-guide catch rates of Red Drum in Florida Bay (Areas 1-5) from 1985 to 2002.

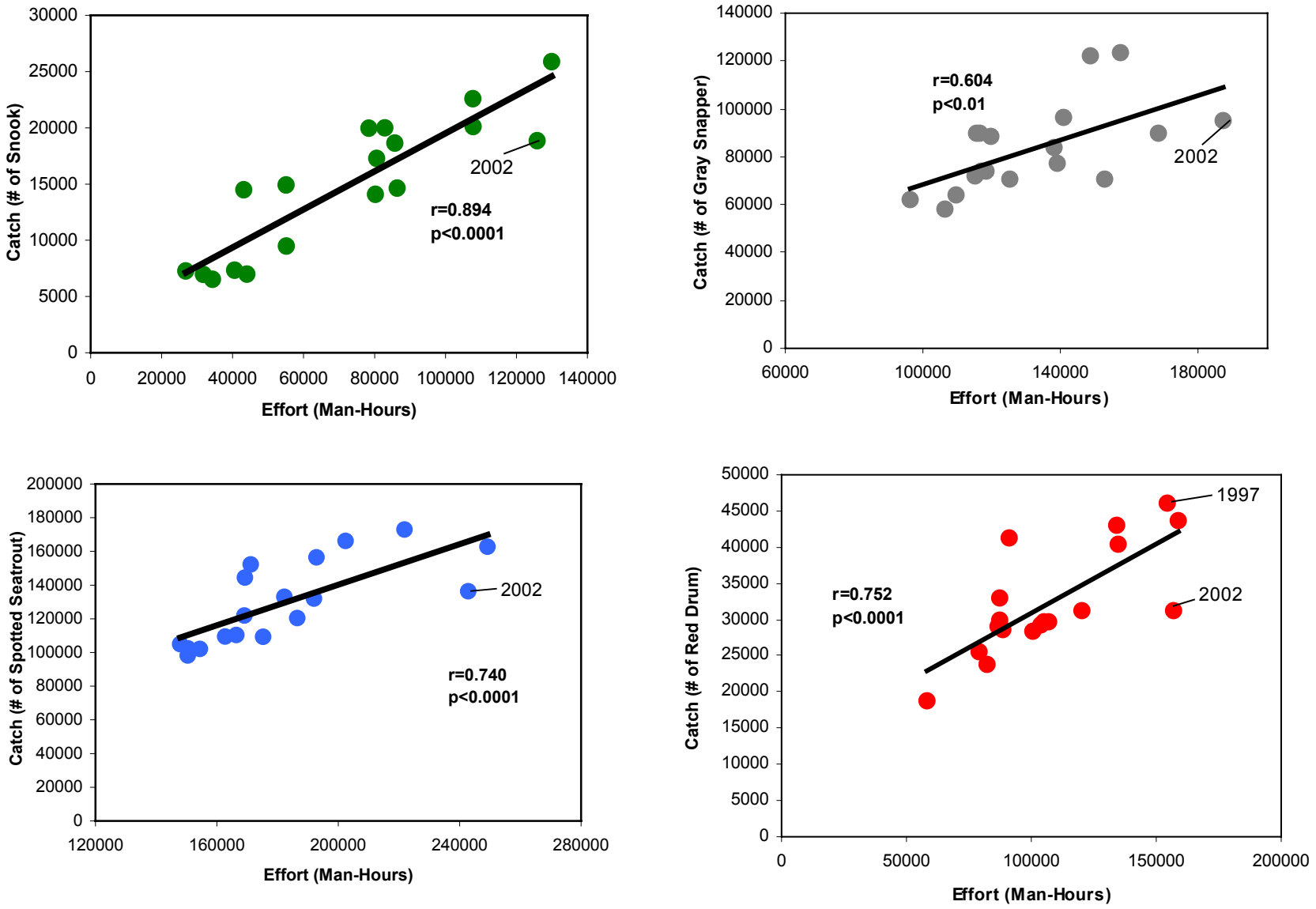


Figure 20. Correlation of total estimated catch and total estimated effort of non-guided (sport) anglers for snook, gray snapper, spotted seatrout, and red drum in Florida Bay (Areas 1-5), 1985-2002.

End of Report